

Propositions for the Transition of IWXXM into Global Operational Service

Concept of Operations for the Transition of OPMET Data Exchange using IWXXM

Issue 1 Draft A

Prepared by the DMG

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1 Introduction

The introduction of the bilateral exchange of IWXXM detailed in ANNEX 3 (AMD 76) from November 2013 is enabling states to issue their OPMET data not only in TAC (Traditional Alphanumeric Codeform) but also in the new AvXML (Aviation XML). This represents the start of a huge change in the provision of textual OPMET data. Since its inception this data has been promulgated on messaging systems to end systems. Initially these end systems were human and the codes were designed with a requirement to be highly compact because of limitations in bandwidth but human readable and there has been little fundamental change since then. With more and more automation the coding practices used for current OPMET data present an obstacle to efficient automation. The specifications on which they are based are not particularly rigorous and state exceptions are common, all of which make the handling of global data difficult to develop and expensive to maintain. This has been exemplified in significant difficulties during code changes.

IWXXM, if correctly governed, represents an opportunity to move to a net centric environment where the systems handling this data can make more use of standard applications to validate, distribute, interpret and present this data. The production of systems which exploit this represents a significant investment but one that should pay dividends in the future through simpler development cycles and through the use of standard data in AIXM, IWXXM and FIXM formats opportunities to create new products cheaply by fusing this data. If the process of providing global data in IWXXM format is unduly delayed however the incentive for this investment will be lost and the development of the standard will be slow and may ultimately fail. In order to prevent this it is essential that the transition commencing in November 2013 is adequately planned and equipped to make reliable global data sets available to users for exploitation as soon as possible. This paper makes some proposals for consideration in achieving that aim.

2 Scope and Goals

This document is intended to document the activities relating to transition, particularly intra-regional and inter-regional exchanges, occurring between 2013 and 2019 the period during which the amendments enabling the transition will be issued to Annex 3.

- Amendment 76 enables the exchange of bilaterally of XML data for those states capable to do so.
- Amendment 77 recommends the exchange of XML,
- Amendment 78 mandates the exchange of XML data.

The document is not intended to define Net Centric services or to provide a fully detailed plan for transition.

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3 Assumptions

Assumptions relating to general principles to be applied have been made in order to drive different phases that will lead to the organisation of a broad IWXXM Exchange to be in place for 2019.

These Assumptions are listed below.

3.1 Regional Variances

Regional variances or extensions (such as remarks sections) shall be removed before the inter-regional exchange. ([Assumption 1](#))

It is assumed that different regions will progress at different rates, it is necessary to create a plan that does not hold us to the slowest rate but also does not detrimentally impact data exchange. ([Assumption 2](#))

3.2 Conversion

In order to minimise as much as possible the conversion between formats until 2019, it is assumed that where Originating Units e.g. aerodrome meteorological offices, Met Watch Offices etc. have an IWXXM capability, both TAC and IWXXM formats will be produced and that these will be consistent with each other. There shall be no conversion from IWXXM to TAC. ([Assumption 3](#))

Note: If this is not adhered to, there is a risk that original TAC and TAC derived from IWXXM may not be consistent because of conversion issues. There is also the risk that data may be converted from TAC to IWXXM to TAC and back to IWXXM without any means of tracking conversions.

Where a conversion from TAC to IWXXM is necessary and conducted, the conversion centre will be identified within the XML message. This conversion centre identifier shall be part of the IWXXM model. ([Assumption 4](#))

To avoid re-circulation of TAC messages translated from IWXXM after the implementation of Amendment 78 to Annex 3 in 2019, all inter-regional exchanges will be carried out using IWXXM. ([Assumption 5](#))

Note: If it happens that TAC exchange is still required beyond 2019 in some regions, this shall be organised (by regional agreement) within the region. Such an arrangement might include XML to TAC conversion.

3.3 Transmission & Routing

Given the size and character set of IWXXM messages, they should not be transmitted by AFTN. The use of File Transfer Body Parts under Extended AMHS is assumed. ([Assumption 6](#))

The current TTAAii structure will be maintained in the XML file naming, the suffix will be used to identify the message type ie TAC or XML (or ZIP, EXI). Further discussions should be held on this subject such as current headers or new headers. ([Assumption 7](#))

Note: There was a strong difference of opinion between members of the DMG with respect to the actual values used for TTAaii. On one side, there was an opinion that IWXXM data should use the same headers as TACs, e.g. SAUK31 for UK METARs and rely only on the file suffix to differentiate between files containing TACs and IWXXM. On the other side, there was an opinion that Message Switching system would require adaptation to route data on the basis of a filename including the suffix and that dedicated headers such as SAUK21 or new headers might be used. What is clear however is that clear guidance must be issued with regard to file naming.

A single bulletin will only contain TAC or XML never both. ([Assumption 8](#))

A single File should contain only one bulletin. ([Assumption 9](#))

3.4 Compliance Testing

It is assumed that agreed accreditation platforms need to be available in each region in order to allow States to test the compliance of XML data to the IWXXM model. This is meant to assure that the data disseminated are operationally usable without problem.

4 Framework

This section is intended to illustrate a framework comprising generalised elements which can be used to establish a framework for the distribution of IWXXM data both within a region and between regions. The intention is that the framework should be flexible to permit Regions to construct an internal structure suitable to their requirements but at the same time allowing the establishment of a disciplined exchange between regions. The framework is organised into a basic set of building block as described in 4.1 and more complex regional entities described in 4.2 which may comprise of a number of the building blocks.

In section 4.1 the building blocks are described by a brief description, an illustration and a list of requirements that should be met for them to carry out their function.

4.1 Basic Definitions

4.1.1 Data Producer/Originating Unit

This function is the origination of METARS/SPECIs, TAFs and SIGMETS, i.e. the data types currently provided for by IWXXM. There may be two types of Data Producers.

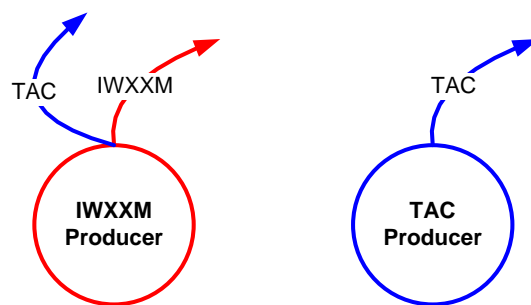
TAC Data Producer

This producer provides TAC data only.

IWXXM Data Producer

In line with the stated assumptions, this producer provides information in both TAC (until 2019) and IWXXM form.

A Data Producer may be an aeronautical meteorological station producing a METAR or SPECI, it may be a Meteorological Watch Office producing SIGMETS, an aerodrome meteorological office providing TAFs. IWXXM producers should provide their data as a Feature Collection to which appropriate metadata shall be applied. The Feature Collection shall then be compressed into file which shall be named according to the agreed convention along with a suffix appropriate to the compression and promulgated on an AMHS connection as an individual IWXXM report.

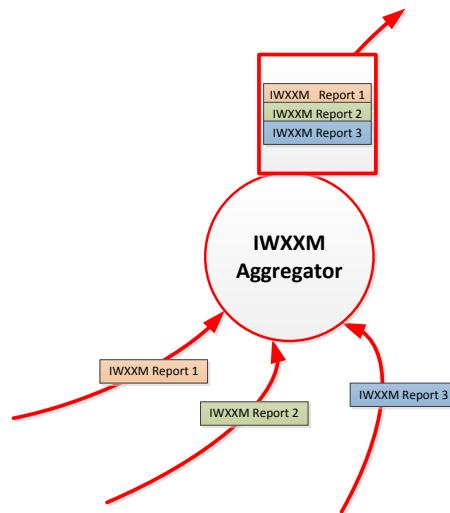


For an IWXXM Producer, the following functions could be the subject of compliance testing or assurance.

- The producers output shall conform to the IWXXM Schema
Note: There may be variations in the schemas as already seen in the US, it may be appropriate to ensure that the IWXXM schema is used for international or interregional distribution.
- The producers output shall pass IWXXM Schematron rules
- The producer will only produce valid codes according to the defined code lists (this should be part of the Schematron rules)
- The producer has an AMHS interface
Note: This may not be necessary, some latitude may be required with the use of GTS provided the data is eventually distributed by AMHS
- The producer shall apply a correct filename to its output
- The producer correctly compresses data applying an appropriate suffix.
- The producer shall apply appropriate (defined) metadata following agreed ICAO rules.

4.1.2 Data Aggregator

This function takes individual IWXXM reports, decompresses them, aggregates them into bulletins and compresses them. As stated in the assumptions, bulletins shall be composed of one or more reports of a single type, i.e. METARs or SPECIS or TAFs. It is assumed that SIGMETs will NOT be aggregated. When aggregating data, the aggregator shall collect incoming data items, which may include bulletins containing a number of data items and combine them as a Feature Collection to which appropriate meta data shall be applied. The Feature Collection shall then be compressed into the file which shall be named according to the agreed convention along with a suffix appropriate to the compression and promulgated on an AMHS connection.

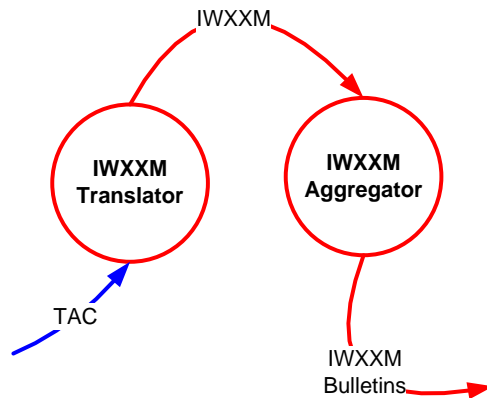


For an IWXXM Aggregator, the following functions could be the subject of compliance testing or assurance.

- The aggregators output shall conform to the IWXXM Schema
Note: This paper suggests that additional metadata is added to a Feature Collection which constitutes a bulletin.
- The aggregator output shall pass IWXXM Schematron rules
- The aggregator produces only valid codes according to the defined code lists
- The aggregator has an AMHS interface
- The aggregator shall apply a correct filename to its output
- The aggregator correctly compresses data applying an appropriate suffix.
- The aggregator shall apply appropriate (defined) metadata following agreed ICAO rules.

4.1.3 Data Translator/Translation Centre

A data translator converts TAC data into IWXXM. To do so, it shall be able to parse incoming TACs and apply the data to IWXXM schema. It is expected that this will be carried out on a bulletin basis so that the translator will always be associated with an aggregator function. The translator shall provide an indication of where and when the translation has been carried out so as to provide traceability in the event of issues with the translation. This may be represented as metadata within a bulletin or it may require an extension to the current IWXXM schema. The translation function does not currently exist and will require significant investigation. It is likely that a proportion of incoming TACs will not be translatable because of non-conformance with TAC standards and there will need to be procedures to deal with these, otherwise IWXXM data will not have global coverage.



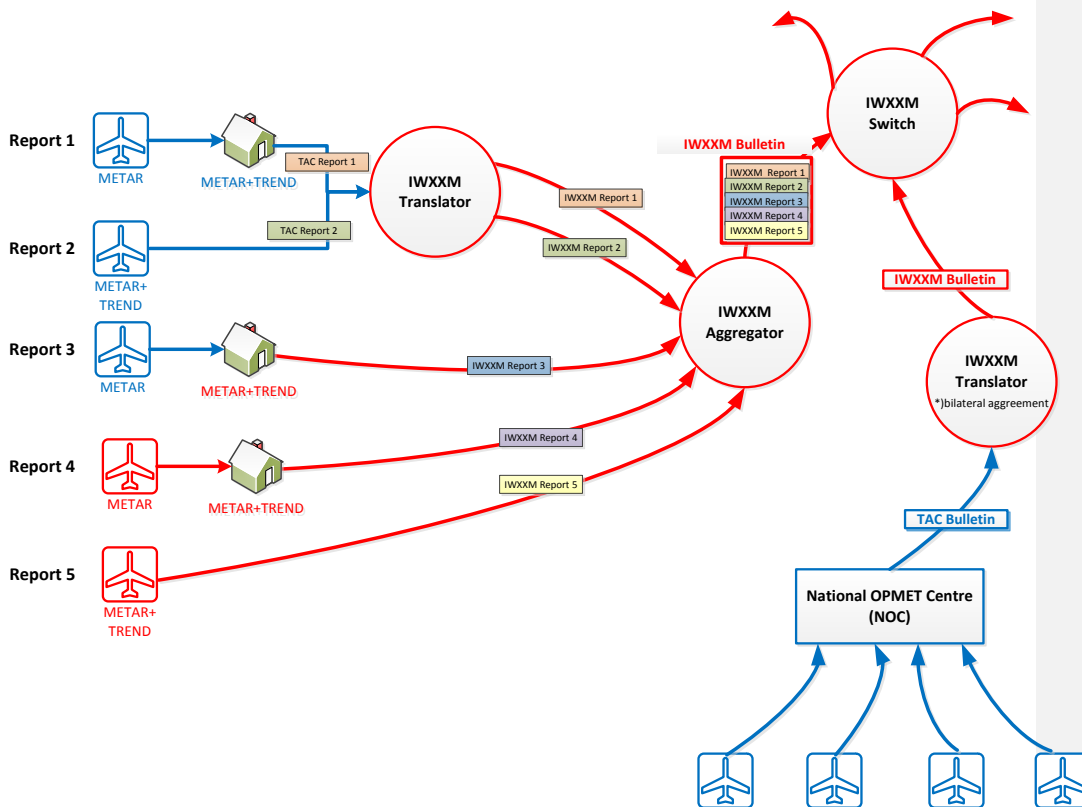
For an IWXXM Translator, the following functions could be the subject of compliance testing or assurance.

- The translators output shall conform to the IWXXM Schema
- The translators output shall pass IWXXM Schematron rules
- The translator shall successfully translate a standard set of TAC test data
Note: This test data set should be agreed at a global level for IWXXM, it may be extended for regional or national variances.
- The translator provides an indication of when and where data has been translated.
Note that because a translator is always associated with an aggregator it may be better to consider the definition of a translator as the sum of the translator and aggregator functions defined above especially if metadata indicating when and where data was translated is included in the meta data associated with the Feature Collection that constitutes a bulletin.
- The translator shall apply appropriate (defined) metadata following agreed ICAO rules.

4.1.4 Data Switch

A Data switch will route bulletins according to their filename, which is assumed to be based on existing mechanism of abbreviated bulletin headers. This function should only require knowledge of the filenames of the File Transfer Body Parts and does not require any access to the IWXXM data as such.

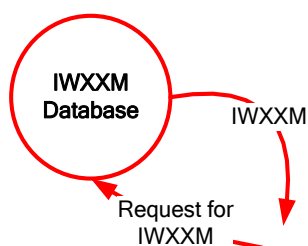
Essentially this should be a standard meteorological switch capable of routing messages according to their headers or filenames to an appropriate set of AMHS addresses. It is not anticipated that any validation of IWXXM shall be carried out by Switches however the arguments raised in section 5.1.3 should be resolved.



4.1.5 Database

A Database will provide the capability for users to interrogate IWXXM data through the AFS in much the same way as the RODBs currently provide for TAC data. The Database will receive IWXXM data from other elements including Data Switches and Translator/Aggregators.

Although the implementation of Net Centric Services is beyond the scope of this CONOPS there is no reason why the Database element should not provide Net Centric services in addition to the AFS based IWXXM interrogation capabilities.



It should be noted that requests for data may require the output to be aggregated should it contain data for a number of aerodromes. A standard set of queries for IWXXM data will also need to be developed and agreed.

For an IWXXM Database, the following functions could be the subject of compliance testing or assurance.

- The Database output shall conform to the IWXXM Schema
- The Database output shall pass IWXXM Schematron rules
- The Database has an AMHS interface
- The Database shall apply a correct filename to its output
- The Database correctly compresses data applying an appropriate suffix.
- The Database shall respond correctly to the standard interrogations

4.2 Regional Definitions

4.2.1 National OPMET Centre (NOC)

The role of the NOC is to collect and validate all OPMET messages generated by the State's originating units, compile national bulletins and distribute them according to the regional distribution schema.

It may also perform conversion to XML of data generated in TAC only by the State's originating units (or delegate another centre if not in a position to do so).

4.2.2 Regional OPMET Centre (ROC)

A ROC is responsible for the collection, validation and dissemination of all required OPMET data from NOCs in its Area of Responsibility (AoR) as well as from the national NOC. The national NOC and the ROC will usually be the same centre.

A ROC is responsible for the Collection of required OPMET data from the other ROC(s) in the region and to send to the other ROC(s) the required data from its AoR.

Disseminate bulletins received from NOCs in the AoR to other ROCs according to predefined distribution lists and others IROGs (see after).

As an example, within the EUR-region, there are three ROCs: London, Toulouse, Vienna.

4.2.3 Interregional OPMET Gateway (IROG)

An IROG is responsible for the collection of all required OPMET data from their Interregional Area of Responsibility (IAoR) and disseminate it to the ROCs in their region.

Furthermore, the IROG is responsible for collection and dissemination of their regions required OPMET data to their partner IROG's in their IAoR.

The IROG is responsible for the quality (or validation) control of the bulletins in their AoR and received from their IAoR.

As an example, within the EUR-region, there are three IROGs: London, Toulouse, Vienna.

4.2.4 Regional OPMET Database (RODB)

The Regional OPMET DataBase(s) (RODB) are supplied with required OPMET data by the ROCs. These databases can be queried via the AFS by using a specified query language and in some occasions complementary networks. As an example, details on that as well as the supported data types can be found in EUR Doc 018, Appendix A (EUR Regional Interface Control Document for OPMET Database Access Procedures).

5 Transition

The first necessary step is to define the prerequisites in order to be able to exchange IWXXM OPMET data. This will impact not only the network itself, but also the Message Switching Systems and most of all the end-user systems.

5.1 Phase 0 Pre –Requisites to Transition

5.1.1 Governance

A responsible group for managing the transition in each region shall be identified. This group shall be responsible for defining the Regions structure and capabilities in the context of the framework. A full liaison should be established and maintained between the ICAO groups in charge of meteorology and data exchange as well as groups in charge of networks.

Budget for inter-regional attendance at other regions responsible group meetings needs to be in place.

The regions will define and have a plan in place to provide IWXXM data. This plan shall be published and maintained by the designated responsible groups (FAQ's etc. shall be available).

An official document (ICAO or WMO) shall be published describing the IWXXM code itself and referencing the appropriate schemas and rules. Only after that, systems can be upgraded in order to handle this new format either by coding national OPMET-data in IWXXM or decoding OPMET data received in IWXXM.

There needs to be an agreement in place to allow for the conversion of data on behalf of a State or Region if a global data set is to be made available anywhere. A State by State letter of agreement does not seem to be a manageable solution.

It is proposed that region to region agreements are set up for:

- 1) The conversion of TAC data from Region A into IWXXM data for Region B for the sole use of consumers within Region B. Such an agreement should be on the condition that translation is carried out by an accredited system or systems of Data Translator centre(s).
- 2) The conversion of TAC data from States within a Region may be delegated to Data Translator centre(s), again which should be fully accredited for use within the Region.

5.1.2 Facilities

An agreed accreditation process needs to be defined in each Region to ensure that data generated by Data Producers is compliant. In order to promote the use of IWXXM, such accreditation should be easily accessible.

An agreed accreditation process needs to be defined in each Region to ensure that translation provided by Data Translators is correct. This accreditation process will be required to provide assurance for Regional and eventually Interregional agreements

An extended AMHS network will be available between those States wishing to exchange IWXXM data.

Extended AMHS connections will be available between those regions wishing to exchange IWXXM data.

5.1.3 Bulletins

OPMET-data exchange is based on the routing of bulletin headers. These bulletin headers are defined in the [WMO-386, Part II, Attachment II-5](#). For the IWXXM messages, there is no specific header defined at this moment of time. As long as the exchange continues to depend on bulletin headers, these headers must be standardised. As stated in Section 3.3, Assumption 7, there are diverse bodies of opinion on this.

1. WMO shall define and officially introduce IWXXM specific headers. The suggestion is that for T1 the letters L, M, and R are presently not used and could be assigned for IWXXM coded messages. T2 could be used to identify the message itself e.g. M for METAR, T for TAF, S for SIGMET or V for Volcanic Ash SIGMET. A1A2ii CCCC could be used the same way as now.
Examples:
LMOS31 LOWM (for METAR reports from LOWW, LOWL, LOWS,...)
LTBX31 EBBR (for TAF reports from EBBR, EBLG, EBOS,...)
LSFR31 LFPW (for a SIGMET for Paris FIR)
2. The existing AHLs shall continue to be used and that system shall be expected to differentiate between TAC and IWXXM bulletins because IWXXM bulletins shall be distributed as compressed files with a file name derived from the AHL. There may be a requirement for some switches to be modified in order to differentiate between TAC and IWXXM bulletins by means of their file suffixes.
3. The existing AHLs shall continue to be used. System shall be expected to differentiate between TAC and IWXXM bulletins because IWXXM bulletins will be distributed as compressed files with a file name derived from the AHL and the AHLs will have been primarily declared as transporting XML in the exchange schema.
4. The inclusion of meta data in a Feature Collection of a number of METARs, SPECIs or TAFs could also be used for routing but would require additional functionality to be included in Meteorological Switches. The metadata definition should be described.

Grouping multiple reports into a web collection does present the opportunity to provide metadata which may be of considerable value. An example of such metadata, provided by a MD Metadata record in the metadata section, is provided below. This example of metadata indicates a number of useful properties of the bulletin including the following:

- A unique universal identifier (uuid)
- A responsible party, which could identify the centre which compiled the bulletin
- A date time stamp, that could indicate the time at which the bulletin was compiled. Such information could be of considerable use in providing performance indicators related to the global distribution of data.

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It should be noted that ISO 19115 requires the inclusion of specific additional metadata such as citations and abstracts so the definition of metadata should be carried out with the assistance of experts in these particular standards.

In terms of AMHS usage a single bulletin file shall be carried as a payload by each individual AMHS message.

5.1.4 Extensions

Despite efforts to standardise meteorological data for aviation it is perhaps inevitable that there will be variation and we can already see that some States are proposing extensions to the IWXXM model. This may be due to emerging operational requirements and must be expected as the use of meteorological data evolves.

It is essential that there is governance over the implementation of extensions and in particular where IWXXM data is exchanged outside of the State or region. Should the extensions be ignored or should they be stripped from data to be promulgated beyond the state or region? The expertise to define this governance is beyond that of the DMG but it will be essential for an efficient global exchange of data and should be built into both governance and accreditation.

5.2 Phase 1 (2013-2016)

Phase 1 will be enabled by amendment 76 in November 2013. Although only bilateral exchanges are defined in the amendment, it is important that this phase maximises the coverage of IWXXM data otherwise there will be no business benefit for many users in adopting the new code forms. The following items are suggested for this phase.

Phase 1 Description

- Item 1 Agreed accreditation platform(s) need to be available in each region as a test bed outside of the operational data exchange. It would be expected that use of the accreditation platform(s) would be without charge.
- Item 2 During this phase, regions will develop and test intra-regional exchange of data in an operational context.
- Item 3 States are encouraged to ensure that source systems are IWXXM capable and are appropriately accredited.
- Item 4 Each region has well defined monitoring and validation processes available with operational procedures (for example correction agreements and rectification for reported faults) to support the distribution of valid data.
- Item 5 Accredited Translation centres will be available on a State or Regional basis to enable data provided by States that are not IWXXM capable to be promulgated in IWXXM form. To do this agreements, enabling delegated translation should be in place. See Section 5.1 Governance.
- Item 6 Data shall be exchanged inter-regionally for test purposes. It is important that during this time procedures for Inter Regional exchange are developed which take into account Regional differences in schemas and how data can be exchanged effectively using IWXXM..

The diagram below illustrates a simple data flow between two States within a Region during this period, one supporting TACs only and the other supporting TACs and IWXXM.

It can be observed that in the state supporting IWXXM data, Data Producers may provide Data in TAC only form or both IWXXM and TAC according to Assumption 3 as stated in section 3.2.

In State 2 an accredited Data Translator can convert TACs, from TAC only Data Producers within the State and if required TAC received from State 1, to IWXXM

Note that the Net Enabled Service is outside of the scope of this document.

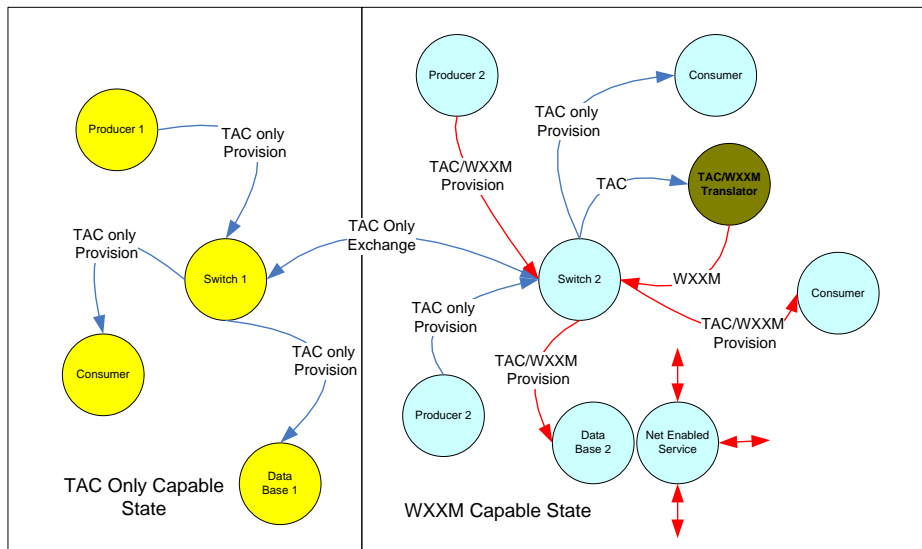
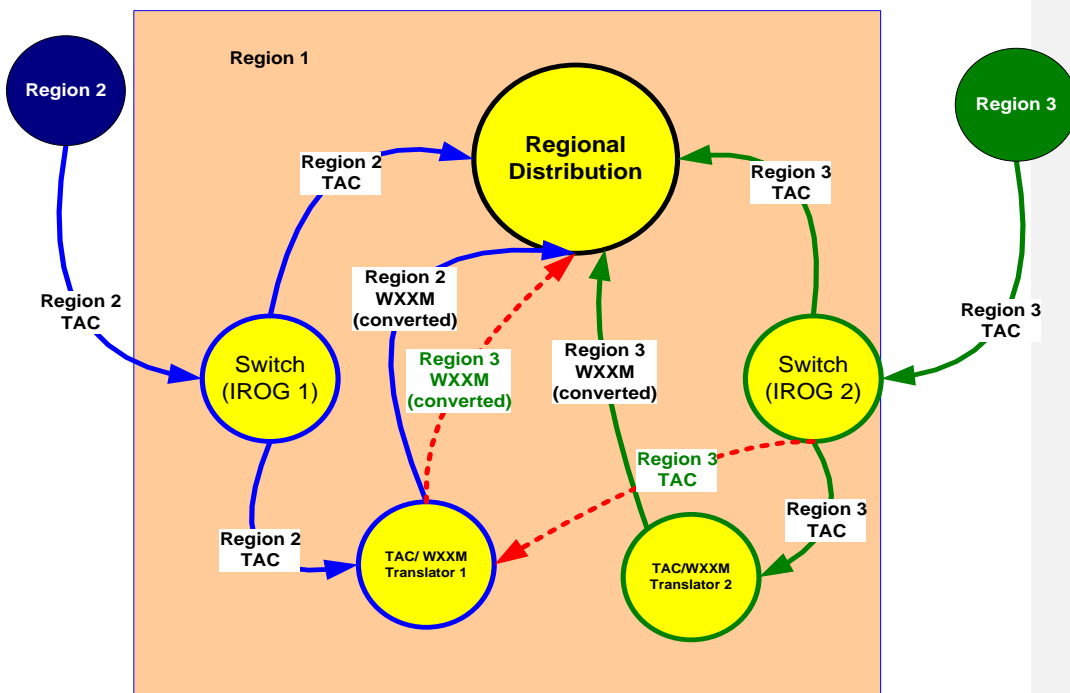


Figure 1: Simple Inter State Exchange

In the figure provided as an example below, the figure shows an IWXXM Capable Region interfacing with 2 other Regions. In this case we assume that there is no operational exchange of IWXXM data between Regions. In this figure, all TAC data received by the IROGs are directed to 2 Regional TAC/WXXM converters. These may be configured in a load sharing mode, each converter having a specific area of responsibility both outside of and inside the region. In the event of a failure of either converter the surviving converter should have the capacity to carry out the task for the entire region. Such a scenario is shown below by the dotted lines which indicate data flow in the event of a failure of Data Translator 2.

The configurations should be decided based on regional agreements.



5.3 Phase 2 (2016-2019)

Phase 2 will be enabled by amendment 77 in November 2016. The exchange of IWXXM data will become a recommendation and should now be used operationally for Interregional Distribution.

Phase 2	Description
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- | | |
|--------|---|
| Item 1 | Inter-regional accreditation processes are agreed and implemented. |
| Item 2 | Regions are ready and structures in place for the inter-regional exchange of data in an operational context. |
| Item 3 | States that are not in a position to exchange IWXXM data are encouraged to make use of Translation centres to ensure they can meet Amendment 78 requirements. |
| Item 4 | The complete FASID requirement for the exchange of IWXXM data is common practice at the end of the period. |

If we consider 3 generalised regions, 2 of which are WXXM enable and 1 which is not, we would expect to see the following exchanges Illustrated in Figure 5.

This scenario assumes the following:

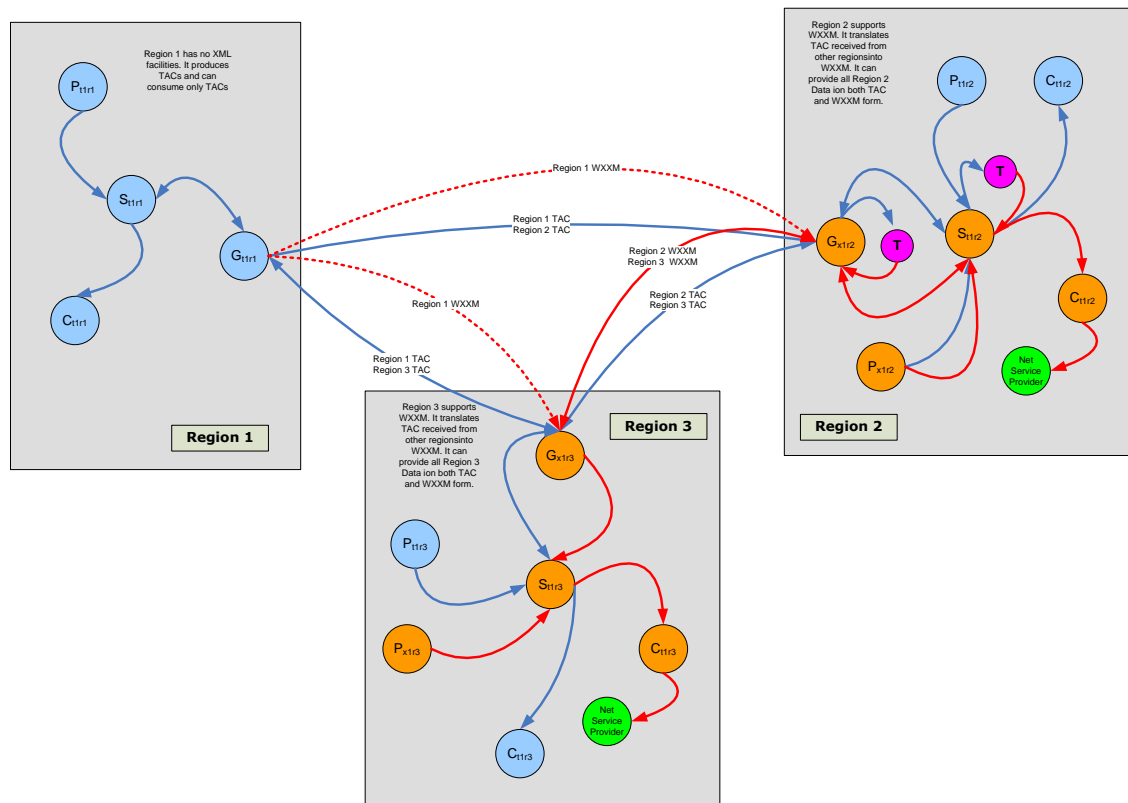
- 1) TAC/XML conversion of Inter Regional TACs is only carried out at Gateway Centres.
- 2) Where XML is produced parallel TAC will also be produced and there is no conversion from XML to TAC
- 3) WXXM includes ability to identify where translation took place.

If we consider the exchange between Region 1 and Region 2, only TACs would be exchanged. It is assumed that all messages provided in Region 2 would be promulgated in both TAC and WXXM form so the data provided to Region 1 from Region 2 will be in a TAC form produced by the originator.

As the transition progresses it may be that Region 1 implements a certified TAC/WXXM Convertor and is able to promulgate WXXM (Indicated by the red dotted line) This would be preferable because translation occurs at 1 point only. If for any reason the Region 1 Convertor failed a fall back would be to reroute Region 1 TAC data to the TAC/WXXM Convertors at Regions 2 and 3.

For the exchange between Region 2 and Region 3, Region 2 would provide data in both TAC and WXXM formats. This would allow data to be routed within Region 2 according to the capabilities of the end users. States within Region 3 that supported both WXXM and TAC would receive both, states supporting TACs only would receive TACs. It would not be until a State had no TAC consumers that it would receive WXXM only preventing a situation where data is transformed more than once.

METG/23 – Flimsy/01



APPENDIX A IWXXM Bulletin Metadata Example

```

<gml:FeatureCollection xmlns:iwxxm="http://icao.int/iwxxm/1.0RC2"
  xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gco="http://www.isotc211.org/2005/gco"
  xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:om="http://www.opengis.net/om/2.0" xmlns:metce="http://def.wmo.int/metce/2013"
  xmlns:gss="http://www.isotc211.org/2005/gss" xmlns:saf="http://icao.int/saf/1.0RC2"
  xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
  xmlns:gts="http://www.isotc211.org/2005/gts" xmlns:gsr="http://www.isotc211.org/2005/gsr"
  xmlns:sam="http://www.opengis.net/sampling/2.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://icao.int/iwxxm/1.0RC2 http://schemas.wmo.int/iwxxm/1.0RC2/iwxxm.xsd
    http://def.wmo.int/metce/2013 http://schemas.wmo.int/metce/1.0RC2/metce.xsd"
  gml:id="SACZ31LKPW041400">
  <gml:metaDataProperty>
  <gml:GenericMetaData>
  <gmd:MD_Metadata>
  <!-- unique identifier for this version of the XML-encoded bulletin; if retranslated later a new UUID should be assigned -->
  <gmd:fileIdentifier>
  <gco:CharacterString>uuid:f5b2f6d0-e57f-11e2-a28f-0800200c9a66</gco:CharacterString>
  </gmd:fileIdentifier>
  <gmd:contact>
  <gmd:CI_ResponsibleParty id="LKPW">
  <gmd:organisationName>
  <gco:CharacterString>Czech hydrometeorological Institute</gco:CharacterString>
  </gmd:organisationName>
  <gmd:role>
  <gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodeLists.xml#CI_RoleCode" codeListValue="originator"
  codeSpace="006">originator</gmd:CI_RoleCode>
  </gmd:role>
  </gmd:CI_ResponsibleParty>
  </gmd:contact>
  <gmd:dateStamp>
  <!-- date-time that XML bulletin created or converted from TAC; in this fictional example it is assumed this is 6 minutes after the nominal time
    ... if conversion by third party, this may be sometime after the initial METAR bulletin publication -->
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  </gmd:dateStamp>
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Formatted: English (U.S.)

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