NTF Format Preservation Assessment

Document History

Date	Version	Author(s)	Circulation
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1. Introduction

This document provides a high level, non-collection specific assessment of the National Transfer Format (NTF) with regard to preservation risks and the practicalities of preserving data in this format.

This format assessment is one of a series of assessments carried out by the British Library's Digital Preservation Team. An explanation of criteria used in this assessment is provided in italics below each heading.

1.1 Scope

This document will focus on the NTF format version 2, conforming to British Standard BS 7567 [1].

Note that this assessment considers format issues only, and does not explore other factors essential to a preservation planning exercise, such as collection specific characteristics, that should always be considered before implementing preservation actions.

1.2 NTF Summary

NTF is a file format developed by the Association for Geographic Information (AGI) [2] for storing and disseminating geographical (primarily topographical [3]) information in vector form [4]. It was used primarily by the Ordnance Survey (OS) prior to a move towards GML based formats in the mid-2000s. NTF is currently still used by Ordnance Survey Northern Ireland for the production of large-scale map data.

NTF defines five levels of increasing complexity[1]:

- Level 1 is used to transfer simple spaghetti[2] features, each with a single attribute.
- Level 2 is used to transfer spaghetti features with multiple attributes.
- Level 3 is used to transfer topologically structured data, which separates geometry from spatial relationships, hence supporting networks, polygons with shared edges, etc.
- Level 4 is also used to transfer topologically structured data, but supports different data models from Level 3, including a rigorous full link/node/face data model.
- Level 5 incorporates a data dictionary which allows users to define the data model for the data being transferred.

2. Assessment

2.1 Development Status

A summary of the development history of the format and an indication of its current status

The first version of NTF was announced in 1985 and this was revised and standardised as BS7567 at version 2 in 1992. In 1999 Fleet noted positive preservation characteristics but also that the format was "subject to periodic revision, having a number of earlier versions" [5].

The NTF standard BS 7567 is split into 3 parts: the specification of NTF structures; the specification for implementing plain NTF; and the specification for implementing NTF using BS 6690 (specification for a data descriptive file for information interchange). All three parts are declared as withdrawn on the British Standards Institution (BSI) website, which notes for each standard: "This standard is withdrawn as it is no longer used. The standard was previously declared obsolescent" [1].

[1] These levels were originally captured from EDINA's Digimap page "What is NTF?" which is no longer available [56]

[2] The term "spaghetti" refers to the unstructured nature between vector features, i.e. there's a lack of explicit relationships between them.

2.2 Adoption and Usage

An impression of how widely used the file format is, with reference to use in other memory organisations and their practical experiences of working with the format

As a primary user (and the Library's main supplier) of NTF files, the history of Ordnance Survey's adoption and subsequent move away from NTF is helpful to understanding adoption of the format more widely. McGarva notes that "the use of NTF outside of Ordnance Survey is limited and is mostly used by consumers who typically convert the data into other formats for use in their GIS" (Geographic Information Systems) [6].

In 1992 OS announced the launch of the Land-Line family of digital map products [7]. Snapshots of the data, with NTF data at its core, were deposited annually with the Legal Deposit Libraries (LDLs) representing years 1998[3] through to 2007 [8]. In 2001, OS introduced their MasterMap technology [9] which moved away from NTF in favour of the XML based Geographical Markup Language (GML) [10]. OS encouraged users to adopt this technology, with the Legal Deposit Libraries starting to receive GML data in 2006 (overlapping with NTF data by a year) [11]. Land-Line was withdrawn two years later in 2008 [12; 13].

OS no longer supplies any of its map data in NTF, with the exception of the topographical Land-Form PANORAMA dataset which has itself been superseded by OS Terrain 50 [14]. The Ordnance Survey announcement states: "Land-Form PANORAMA was an unmaintained product and was last updated in the 1990s. The new product will give users more confidence in the currency of the data and will be supplied in additional formats, making it far more accessible" [15].

Ordnance Survey Northern Ireland has been depositing annual snapshots of NTF with the UK Legal Deposit Libraries since 2004, and still produces its large scale map data in NTF. The OSNI implementation of NTF is independent from that of OS, and differs slightly (see commentary under the Migration heading in Section 2.3.2).

The opening up of some of OS's digital data products under the 2010 "OS OpenData" initiative [16] has rapidly changed the way its map products are digested and utilised [17; 18]. It seems unlikely that this period of change is at an end, with online and interactive possibilities that take advantage of OS linked data [19], itself quickly evolving [20], likely to spur further evolution. In such a quickly evolving technology area, a knock-on effect on the underlying data formats and how they are consumed is distinctly possible.

Such evolution of formats is likely to also have a subsequent impact on the knowledge availability for the previous generation formats. NTF experience in memory organisations has been centred around the UK Legal Deposit Libraries, as noted above, and at Edina Digimap, a JISC-funded service designed to "deliver maps and map data of Great Britain to UK tertiary education" [21]. During the half-year time-frame over which this report was prepared however, website information about NTF was removed from Edina Digimap pages (see Section 2.4) apparently due to lack of interest and use for that format. Evidently, the disappearance of production and consumption of NTF formatted data is already having an impact on the expertise and knowledge available about that format; this trend in knowledge availability can only be expected to continue to follow the trend in format use.

2.3 Software Support

2.3.1 Rendering Software Support

An overall impression of software support for rendering the format with reference to: typical desktop software; and current support on British Library reading room PCs

NTF is effectively a dataset that might be analysed, applied, projected or viewed in a number of different ways. It can be combined with other data in different formats, for example OS raster information.

[3] OS started depositing in 2009.

At the British Library

In order to search and view NTF map data files, a collaboration with the other Legal Deposit Libraries in the late 1990's led to the creation of a standalone application that sits on top of (and that cannot operate in isolation from) MapInfo Professional® [22] for viewing converted[4] Land-Line (NTF) data in LDL reading rooms [5].

Other support

In the late '90s, OS provided a Land-Line View tool[5] for viewing Land-Line data, along with a simple viewer for its NTF data called OSView [23], although this was made unavailable by OS in early 2001 [24]. OSView version 3.0 is still available for download via GeoCommunity website[6] [25], although without any source code.

Although unclear, EDINA's Data Convertor Reference Table [26] suggests that both Qgis [27] (open source) and Autodesk [28] (commercial) support the NTF format [26], although there is no reference to NTF in the current Qgis documentation [29]. The Table also suggests that conversion is needed prior to import to ArcGIS [30] (commercial) or MapInfo products [22] (commercial with a free cut down viewer).

2.3.2 Preservation Software Support

An impression of the availability and effectiveness of software for managing and preserving instances of the file format

Format identification

NTF is a text-based format that is not identified by DROID, JHOVE or Apache Tika. The .ntf extension is not enough to aid identification as it is used to identify a number of other file formats such as Lotus Notes [31] or the National Imagery Transmission Format [32]. Open Source software such as QGIS or the GDAL/OGR library (see Metadata Extraction below) may provide some functionality or guidance that may be useful in supporting format identification.

Validation, Conformance Checking and Detecting Preservation Risks

GeoLint [33], developed at the British Library, is a prototype tool designed to validate NTF files by opening them and ensuring they can be read successfully by the GDAL/OGR library (see Metadata Extraction below). No other tools for validating or quality checking NTF files are known.

Metadata Extraction

The Open Source Geospatial Foundation [34] has developed an open source abstraction library for geospatial data formats called the Geospatial Data Abstraction Library (GDAL) [35]. It incorporates support for both raster and vector based geospatial formats, the latter of which is provided by the OGR[7] Simple Features Library which has been loosely integrated with the raster oriented GDAL library. Together, GDAL and OGR "presents a single raster abstract data model and vector abstract data model to the calling application for all supported formats" and "comes with a variety of useful command line utilities for data translation and processing" [35]. In particular, GDAL provides support for extracting metadata from an NTF file, with a detailed example on the ogrinfo help page [36].

[4] British Library MapViewer, bespoke software developed for the British Library by Dotted Eyes Ltd [69] using their InterpOSe [70] and TranspOSe tools [47] to convert NTF files to MapInfo TAB files [48].

[5] Available (un-verified in terms of source or ability to execute) via the Internet Archive [68]

[6] The OSView executable has not been verified (in terms of source, or ability to run). To download OSView from GeoCommunity FTP server it was necessary to add *.geocomm.com as an exception to the proxy settings, see: http://www.geocomm.com/faq/30.html

[7] OGR used to stand for "OpenGIS Simple Features Reference Implementation", but it is not fully compliant with the OpenGIS Simple Features specification, nor is it a reference implementation, so the name was changed to "OGR Simple Features Library" with OGR remaining for historical reasons [72].

Migration

A number of tools are available for converting NTF format files into other formats enabling NTF data to be imported into GIS applications [37]. These tools may be included in GIS packages or obtained as separate applications [38; 39; 40]. The accuracy of these conversion tools is unknown with suggestions from various sources that there is sufficient variability in implementations of NTF for issues to potentially arise. For example, "NTF2MIF does not translate OSNI or OSI data" [41], implying a difference with these NTF files from others; this is supported by the claim that "OS (NI) and OS (I) NTF data are enhanced versions of the GB NTF data format" [42] and by findings from GDAL that "some [NTF] data products (OSNI datasets) not from the Ordnance Survey … have record groups in unusual orders compared to what the UK Ordnance Survey does" [43]. Even without these challenges, migration is still difficult. McGarva notes that "because conversion of geospatial data across formats, data structures, and applications often results in loss of data or data alteration, the migration of geospatial formats over time is not easily automated, but instead must be evaluated on a case-by-case basis" [6].

Migration tools (not inclusive):

- The GDAL [35] library (see above) documents support the NTF format [43] and provides a command ogr2ogr for converting NTF files to a range of vector formats [44]. There are a large number of applications that utilise GDAL including several major GIS systems [45]. GDAL appears to have an active developer community [46].
- MapInfo transpOSe [47] software was used, from 1999 to 2013 (while the Legal Deposit Libraries were using Dotted Eyes to provide access to the data), to migrate OS NTF (and GML) annual snapshots to MapInfo TAB files [48].
- Safe Software Inc.'s Feature Manipulation Engine (FME) tool [49] provides a transformation engine (and automated workflow environment) for transforming data between formats, including OS (GB) NTF [38]. This tool, along with GDAL, was used from late-2013 to bulk load and batch data process individual map tiles into the PostGIS database [50].
- NTF2MIF [39; 41] is a free tool for converting NTF to MIF format (MapInfo exchange format) but is no longer supported. It specifically lists support for the following mapping products: "Land-Line Plus; Meridian 2; Strategi; Landform Panorama Contour and DTM; Landform Profile Contour and DTM; OSCAR Traffic-Manager; OSCAR Asset-Manager; Code-Point NTF" but "does not translate OSNI or OSI data" [41].
- MyGeodata Convertor is an online conversion service that supports NTF [51].

2.4 Documentation and Guidance

An indication of the availability of practical documentation or guidance with specific reference to the facilitation of any recommended actions

The NTF format is well documented as a published standard [1], with detailed descriptions of some specific implementations available, such as the user guides for OS Land-Form PANORAMA which include a technical specification [52] of how this particular data set is realised within the NTF (and DXF [53]) format. Some documentation that accompanies various software tools (referenced above) provides further practical documentation and indications of implementation detail, for example, GDAL's NTF material [43].

The British Standards Institution (BSI) holds the documentation for the NTF standard in their archive (despite it being "withdrawn", see above) and are able to supply it for a charge on application, even though it is not available via their online shop [1]. A number of other websites still sell what appears to be the same standards documentation, such as the American National Standards Institute (ANSI) [54].

In general, documentation about the NTF format and tools appears to be in decline, seemingly in response to a decline in NTF usage. In the time taken to produce this report, for example, EDINA have removed resources about NTF as they no longer supply much data in that format (a brief description of NTF remains [55], however the further information "What is NTF?" resource is no longer available); worse still, EDINA's information is not captured in the Internet

Archive. If this trend continues, knowledge about the format - which could potentially include the specification itself - will be hard to find, presenting a long-term preservation risk.

2.5 Complexity

An impression of the complexity of the format with respect to the impact this is likely to have on the British Library managing or working with content in this format. What level of expertise in the format is required to have confidence in management and preservation?

Fleet notes that the NTF format "has the advantages of being non-proprietary, well-documented, with a comprehensive and consistent structure, and readable by any ASCII text editor. However, in common with many geographic data formats, it requires special software to view" in a practical and meaningful form [5]. Specific expertise in working with NTF is likely to prove useful in supporting digital preservation activities given the variance in NTF implementations and the decline in available documentation. The level and/or availability of such expertise may have a bearing on the timeliness of preservation actions.

2.6 Embedded or Attached Content

The potential for embedding or attaching files of similar or different formats, and the likely implications of this

NTF does not support the embedding of content.

2.7 External Dependencies

An indication of the possibility of content external to an instance of the file format that is complimentary or even essential to the intellectual content of the instance

Although not as complex and compound in nature as many GIS formats, NTF files do need to be considered within a wider context. What area does an NTF file represent? How does the data within one NTF file relate to that in another NTF file? What coordinate reference system is used to locate the NTF data within its wider context[8] (and that of other data) [37]? McGarva notes "A major challenge in adapting some types of geospatial data with digital repository environments is that of reconciling the 'item' orientation of many repositories with the 'collection' orientation of many geospatial data types. The item formation process associated with repository ingest can lead to atomization of large, complex, and interrelated sets of geospatial content unless proper component relationships are built into the repository structure. Data that is item-like in nature (e.g. individual digital maps or datasets, which may themselves be multi-file and multi-format in nature) may fit best in digital repositories, while more complex content might need to be managed in a file system structure or within a spatial database" [6].

2.8 Legal Issues

Legal impediments to the use, management or preservation of instances of the file format

None known.

2.9 Technical Protection Mechanisms

Encryption, Digital Rights Management and any other technical mechanisms that might restrict usage, management or preservation of instances of the file format

None known.

2.10 Other Preservation Risks

Other evidence based preservation risks, noting that many known preservation risks are format specific and do not easily fit under any of the sustainability factors above

[8] For example, OS Land-Line is in the National Grid coordinate reference system defined by OSGB36 triangulation.

None known.

2.11 Preservation Risk Summary

A summary of preservation risks and recommended actions (where possible).

NTF was employed primarily by Ordnance Survey for representing topographical data; however in 2014, in terms of its creation and usage, it is now largely an obsolete format. Although not as challenging from a preservation or management perspective as modern GIS formats, there are a number of key risks faced that are likely to become more problematic over time. Documentation about the format appears to be in decline and not readily available from the standard's supplier themselves. Software support for rendering and migration is reasonable if not widespread and support provided by the open source GDAL library is encouraging. However, the accuracy or completeness of that support for the NTF format (and for implementations by those other than OS) is unclear. The lack of tools or approaches for automatically validating or checking the completeness of an NTF based collection poses a major challenge to potential data migration action. Pre-emptive migration (or at least, experimentation and documentation) while expert knowledge of the format is still available may be beneficial to future preservation efforts.

- **Inaccessible and declining level of documentation and expertise**
  - Documentation, including the NTF specification, appears to be becoming increasingly harder to access, especially as NTF usage wanes, posing a risk to understanding of the data.
  - Declining usage affects the level of expertise available potentially impacting the ability to deliver effective preservation of this material.
- **Variations in implementations of the NTF format**
  - Different implementations of NTF may pose challenges for rendering or migrating collections, particularly when coupled with difficulties obtaining documentation or lack of expertise.
- **Unknown accuracy or completeness of support in rendering and migration tools**
  - Unknown abilities of migration tools may mean migration could unknowingly be lossy or otherwise erroneous.
- **Lack of support for automated validation, completeness or quality checking**
  - Only one prototype tool (GeoLint) is known to exist and relies on the ability of GDAL to successfully process the NTF file.
  - Manual experimentation and handling is likely to be necessary.
- **Lack of support for automated format identification**
  - Format identification may be challenging, although .ntf file extensions may be dependable within a collection of known OS origin (however this may not be helpful for repository wide format characterisation).
- **External dependencies**
  - Placing data within the wider context may be challenging. Interdependencies on other data may not be clear and complicated by atomisation due to repository ingest.

3. Handling and software recommendations

Recommended actions in usage and handling of the format. Recommend actions in the support or development of software applications that provide, or have the potential to provide, significant risk mitigation for the format. Note that these recommendations do not take into account other requirements such as those driven by specific British Library collections, or non-preservation issues such as resourcing.

Understanding and experience of the format seem vital to successful preservation of NTF material, especially when variations in implementation are considered. Unfortunately, documentation and use are in decline, meaning timely preservation actions are paramount to ensure knowledge is captured for the long-term preservation of this material.

Handling Recommendations

- Understanding the source, documentation and compound nature of collections involving NTF will be key in making correct preservation planning decisions. Preservation actions are likely to be highly dependent on the specifics of each NTF based collection.
- Consideration should be given to the need to migrate NTF data to a better supported format while expertise in working with the format can still be found.

Knowledge Recommendations

- Ensure the NTF specification is preserved in an appropriately accessible technical registry as representation information.
- Ensure other technical documentation relating to received NTF collection material is also captured and preserved. For example, ensure relevant web-pages regarding the format are archived, and/or approach OS for any documentation relating to now obsolete datasets.
  Develop in-house working knowledge of the format, particularly with regards the varying implementations.

Software Recommendations

- Assessment of the performance of the GDAL library (and other tools) in migrating NTF data (from different sources) would be useful in establishing its value in mitigating preservation risk relating to future access.
  - Without confidence in GDAL, there may be considerably greater dependence on undocumented and unsupported tools and hence significantly greater preservation risk.
- Invest development effort in identification of NTF (and other geospatial) files.
- Invest development effort to create and maintain appropriate validation and quality assurance tools.
- Choose and/or develop repository technology appropriately for geospatial content, in particularly to minimise atomization of interrelated geospatial data by ensuring component relationships are captured (where appropriate)

Monitoring Recommendations

From a technical perspective, the preservation risks faced by NTF are unlikely to change rapidly and so review of this document should not be considered a high priority. Any monitoring activity should take into account the availability of expertise in working with NTF and support by software applications for reading or migrating it.

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