

# Neo Notes Data

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## File format

NeoLAB Convergence Inc.

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## 1. About this document

Neo Notes iOS app is designed to visualize strokes from Neo smartpen N2. The strokes are generated by N2 and transferred to Neo Notes through Bluetooth. The data from N2 are saved as a file in a location for Neo Note app.

This document is mainly about the file format. With Neo Notes app we can save stroke data from N2 and record voice memo. So the file can have strokes and audio files.

Also each stroke and voice memo has time stamps. We can render strokes while playing a voice memo synchronized with the time stamps.

## 2. Components

N2 generates data from trajectory on paper. The trajectory is saved as stroke. Strokes on the paper are grouped and saved in a page. So a page is representing a sheet of paper. And some pages are grouped and make a notebook.

While stroke, page and notebook are related to data from N2, there is voice memo which is recorded and saved by Neo Notes app itself.

### 1.1 Notebook

Neo Notes has two kinds of notebooks. The first one is representing real world notebooks where N2 is writing on. The other is called digital notebook which can be made up from existing pages.

Each notebook has its own ID. Data from N2 always has a notebook ID so that we can find the notebook's size, x/y ratio and a cover image. To render trajectory data correctly it is very important to know the size information of the notebook.

### 1.2 Page

When a user is writing on a notebook with N2, he is actually writing on a page in the notebook. Page is the real container of the strokes N2 is gathering.

Most activities Neo Notes is performing are based on page data. Rendered a page, exporting a page and replaying a user's writing are all done with a page.

There are three different types of data. Normal strokes are strokes from N2. Editing strokes are strokes added with Neo Notes' editing menu. The last type is for voice memo.

Voice recording is Neo Notes app's functionality. A user can capture voice memo with Neo Notes while taking note with N2. Most importantly the voice memo also has timestamp. We can replay the voice memo at the same time replaying the strokes from N2 with synchronized timestamp.

The audio data is not part of the page data. The page data has minimal time information and audio file name. The audio file is m4a format and located at a separate location.

### 1.3 Stroke

Stroke is a basic unit of data from N2. It is composed of multiple numbers of dots – a pair of x, y coordinate. But the dots are always used as a part of a stroke.

A stroke starts when N2 touches a paper and gathers trajectories and ends when N2 is getting off from the paper. If a user is writing a character 'A', it will normally generate 3 strokes.

Another way to create strokes is editing existing pages. Instead of using N2, a user can add strokes from Neo Notes app by fingers on the screen.

### 1.4 Voice Memo

Unlike strokes, voice memo is taken by Neo Notes app. The file format is m4a but some early version of Neo Notes Android app was using wav format.

The audio file is saved at a specific location different from a page file. The page file has some meta data about the voice memo. We can find out when the memo started and what name the audio file is from the page data.

Another thing note is that a voice memo can be captured through multiple pages. For the case the page file has information about page numbers where the audio is related to.

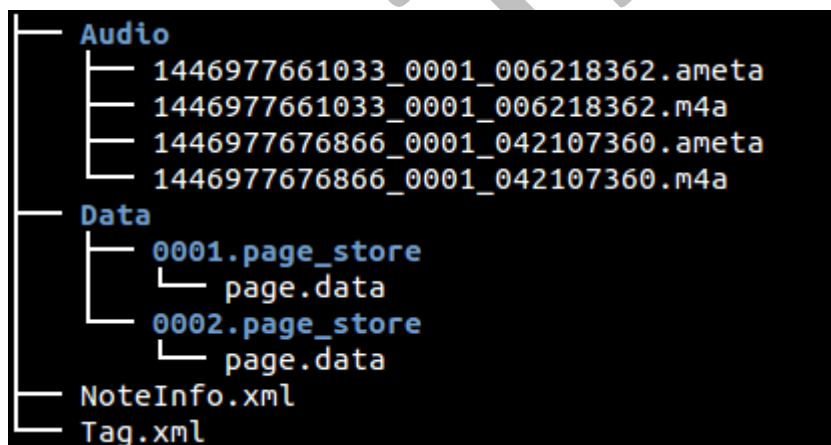
As we can trace time and page changes we can replay the audio along with strokes by synchronizing them.

## 3. File Format

### 3.1 Notebook

It is a file format originally created for archiving data to Google Drive. The file includes all data related to a notebook such as pages, strokes and voice memo. The extension of the file is neonotes. The internal file structure is a pure zip file format.

For example if you have a file named 0B9QH0FvJ6KLhdzZicVIUYVZwa0U.neonotes and unzip the file with a unzip program you can see the content of the file.



#### 3.1.1 Data folder

The folder has pages. A page is saved as a file named page.data and the file is located to a sub folder with a name like 0000.page\_store. There are leading 4 digits which represent page number of the page.

#### 3.1.2 Audio folder

This is where the audio files for voice memo are located.

Each voice memo has a pair of files. M4a file is a audio file and ameta file is an xml file including meta information of the voice memo.

### 3.1.3 NoteInfo.xml

The xml file has information about the notebook.

Please have a look at the table below for details.

Tag	Type	Content	
notebookId	Integer	Notebook ID	
notebookUuid	String	Notebook UUID	
notebookGuid	String	Evernote GUID	
totNoPages	Integer	Total number of pages	
notebookTitle	String	Title	
lastModifiedDate	long	Date last modified	
createdDate	long	Date created	
timeTitleModified	long	Date – title modified	
coverImage	Image	Cover image	
isArchived	Integer	0 : archived 1: active	
archivedDate	long	Date archived	
Type	Integer	0:Digital notebook	

Example NoteInfo.xml

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<NoteInfoFile
Version="0001"><notebookId>604</notebookId><notebookGuid></notebookGuid><totNoPages>0<
/totNoPages><notebookTitle>Plain Note
01</notebookTitle><createdDate>1446465179581</createdDate><lastModifiedDate>14469776917
23</
lastModifiedDate><timeTitleModified>1446465179581</timeTitleModified><digitalNoteType>5</di
gitalNoteType><digitalNoteCover>CustomCover.  png</digitalNoteCover></NoteInfoFile>
```

### 3.1.4 Tag.xml

This file includes tags generated with Neo Notes.

```
<?xml version='1.0' encoding='UTF-8' standalone='yes' ?>
<TagFile version="0001">
<Tag String="school" notebookUuid="" pageUuid="" />
<Tag String="student" notebookUuid="" pageUuid="" />
</TagFile>
```

## 3.2 Page

Page is the most important part of the data Neo Notes is handling. The file is saved under Data folder with a parent folder name with a page number. The data is saved as a file named page.data.

For example if a page number is 20, the page is saved as page.data under the 0020.page\_store folder.

### 3.2.1 File structure

The table below is describing the structure of the file page.data.

Name	size(byte)	Content	
File ID	3	String "neo"	
File version	4	File version number. 2 is the latest version	
noteld	4	Notebook ID	* 4
Page No	4	Page number	* 4
notebook width	4	dot code width of the notebook (Float 32)	* 3
notebook height	4	dot code height of the notebook (Float 32)	
Created time	8	timestamp(millisecond)	
Modified time	8	timestamp(millisecond)	
dirtyBit	1	A flag if the data is modified	
Number of strokes	4	Number of strokes	
stroke data	Varying	Stroke or voice memo data	* 1, 2
Length of guid string	4	Length of guid string	
Page guid string	Varying		

### Stroke

Name	size(byte)	Content	
Type	1	0 - Stroke (1 if it is voice memo)	
Color	4		
thickness	1	0, 1, 2	
Number of dots	4		
Start time	8	timestamp(millisecond)	
dot data	Varying	Each dot is 13 bytes x : Float 32 y : Float 32 pressure : Float 32 time diff : 1 byte – time difference from a previous dot	

### Voice memo

Name	size(byte)	Content	
Type	1	1 - voice memo (0 if it is stroke)	
Time	8	timestamp(millisecond)	

Filename	60	The name of audio file. Null terminated string	
status	1	0 - voice memo start 1 - voice memo page changing 2 - voice memo page changed 3 - voice memo end	
Notebook id	4		
Notebook UUID	30	null terminated string	
Page Number	4		

#### \* Note

##### 1. stroke data

Ever dot from N2 is saved after normalized to a value between 0 and 1.

The normalization is done with the notebooks width or height as denominator. A longer one is used for the calculation.

$(x \text{ or } y \text{ dot code from N2}) / \text{MAX}(\text{width, height})$

With x, y coordination, N2 gathers pressure information on writing. The pressure is normalized as well. The value pressureMax from N2 is used for the calculation.

##### 2. Meta information for voice memo

The audio file for each voice memo is saved as a separate file.

But for the replay, meta information such as time and page number is saved in the page file.

##### 3. Notebook width, height

The width and height of the notebook are important to render the strokes.

With the information we can decide the size of background where the strokes are rendered on. Also if we need to recover the original coordination of a dot the longer one of width and height is the value we need to use.

##### 4. note ID, page number

The values are added from the file format version 2.

### 3.3 Voice Memo

Each voice memo in Audio folder exists as a pair of two file. M4a is audio file for the memo and ameta file is a meta file for the voice memo.

```
<?xml version='1.0' encoding='UTF-8' standalone='yes' ?>
<AudioMetaFile version="0001">
<VoiceMemo TimeStamp="1423461250711" notebookUuid ="23" PageNumber="3" />
<VoiceMemo TimeStamp="1423461254394" notebookUuid ="23" PageNumber="4" />
</AudioMetaFile>
```

The meta file above says that the voice memo started from page 3 and changed to page 4.

Although we have a defined value for voice memo in the file format, we don't have data about voice memo in page data. If you want to add the meta data to the stroke list, you do it by comparing timestamp and adding voice memo meta to the list.

Below is an example with the xml above.

1. Read page.data for page 3.
2. Look through strokes and find a location for timestamp 1423461250711 and add a voice memo with status 0(voice memo start).
3. Look through strokes and find a location for timestamp 1423461254394 and add a voice memo with status 1(voice memo page changing)
4. Read page.data for page 4.
5. Look through strokes and find a location for timestamp 1423461254394 and add a voice memo with status 2(voice memo page changed).
6. For the time of voice memo end, we can calculate it by adding the time length of the audio file to the time of the stgart.

The example above is to add voice memo information to the list of strokes. It's a just example. We don't need to add the voice memo information to the list as long as we can synchronize time for strokes and voice memos.

## 4. Rendering a page

Rendering is process to visualize strokes to an image.

### 4.1 Strokes

Stroke is a basic unit of data from N2. It is composed of multiple numbers of dots – a pair of x, y coordinate. But the dots are always used as stroke.

A stork starts when N2 touches a paper and gathers trajectories and ends when N2 is getting off from the paper. If a user is writing a character 'A', it will normally generate 3 strokes.

Each stroke has following information.

- Type: It is always 1.
- Colour: 32bits RGBA value.
- Pen thickness : A value set by Neo Notes
- Number of dots : The number of dots in a stroke
- Start Time: The time when N2 touched a paper.
- dot data
  - x, y : 0 ~ 1, float
  - pressure : 0 ~ 1, float
  - time diff : time difference from a previous dot



## 4.2 Recovering coordinate

Dot coordinate in stroke is value after normalized.

To get a value for rendering from the normalized value we need to know the denominator which was used for the normalization.

More precisely we don't need to know the actual value used for the normalization. The important information for rendering is the ratio of width and height and the one which is longer than the other.

## 4.3 Rendering

Once we have coordinates for the target screen, we can render the trajectories with vector graphic techniques. The pressure value can be used to visualize varying thickness of the rendered trajectory.

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