



OpenEyes - Incoming Clinical Data

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Target Audience

General Interest	✓
Healthcare managers	✓
Ophthalmologists	✓
Developers	✓

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Introduction

The ambition of OpenEyes is to be a 'clinical portal', that is a single interface between the clinician and all relevant clinical data about the patient. Modules are being added to the project in order to allow the recording of clinical information that is synchronous (for example the findings of an examination, or the contents of a discharge summary).

However, clinical data often arrives in an asynchronous fashion, and there is therefore a need to establish a reliable means of dealing with that information as it arrives. Examples of such data include incoming correspondence, and results of clinical investigations. The vast majority of items of clinical information are legitimately stored within OpenEyes as part of a treatment episode. Therefore, wherever possible, incoming information should be automatically stored in the appropriate episode. Unfortunately there will inevitably be occasions on which it is not possible to determine which episode the information should be associated with. Examples are;

- A referral letter which arrives prior to an episode being established
- An unsolicited item of data (such as an OCT image from another hospital) for a patient with more than one service episode currently open
- An investigation result where the request is not logged, and the result could apply to more than one service

Therefore, a mechanism is required to deal with such incoming clinical data, including user intervention when required.

Modes of Arrival

Clinical data may arrive in a variety of forms, and examples of these are summarised in the following table, along with a short description of the proposed method of dealing with each.

Item	Mode of arrival	OpenEyes Processing
Paper letter	Post or other physical delivery	Scan and save to a directory, user confirms and imports
Email	Email inbox	Forward to an OpenEyes inbox
Blood test	HL7 message	Read and import message
Humphrey field	Saved to networked drive	Detect presence of file, and import

Automatic Handling

Wherever possible, OpenEyes should process the arrival of clinical data without user intervention, provided that this can be done with a high degree of success and patient safety. However, given the requirement to store data within a clinical episode, it is necessary to determine the correct episode to associate the data with. There are several scenarios which are described here;



1. No episode established

This will commonly occur when a referral letter arrives, or is signalled through Choose and Book. As with correct clinic choice, there is no reliable way that an episode associated with the appropriate service can be established without user intervention in the form of letter scrutiny.

2. Single episode open

If there is already an open episode for the patient, then it may be reasonable to assume (for many types of incoming data) that this is the correct episode to associate the data with. While there will always be some cases where this assumption proves to be wrong, it will be correct for the vast majority of cases. In order to deal with exceptions, there is a need for a seamless mechanism of correcting the assignation of an episode where errors do occur.

3. More than one episode open

Although it is certainly the case that some services expect incoming data of certain types (for example a visual field is much more likely to be associated with the glaucoma service than the vitreoretinal service), this cannot be relied upon. There are no examples of investigations that could never be ordered by a sub-specialty. This scenario will therefore also require user intervention to resolve.

Processing

The processing of incoming data of all types may be summarised in the flow chart in figure 1. Examples of clinical data meeting the conditions in the flow chart are as follows;

Full episode information

An example of this include an HL7 message, or letter containing valid patient information, and a reference to an investigation request already associated with a patient episode.

Partial episode information

Incoming images (such as visual fields) might contain full and valid patient information (eg name and NHS number), but insufficient information to associate them with an obvious patient episode.

Ambiguous patient information

An example might be a visual field where the name and the hospital number do not match. Even in principle there is no way of determining which of the two values (if either) is correct, so user intervention will once again be required.

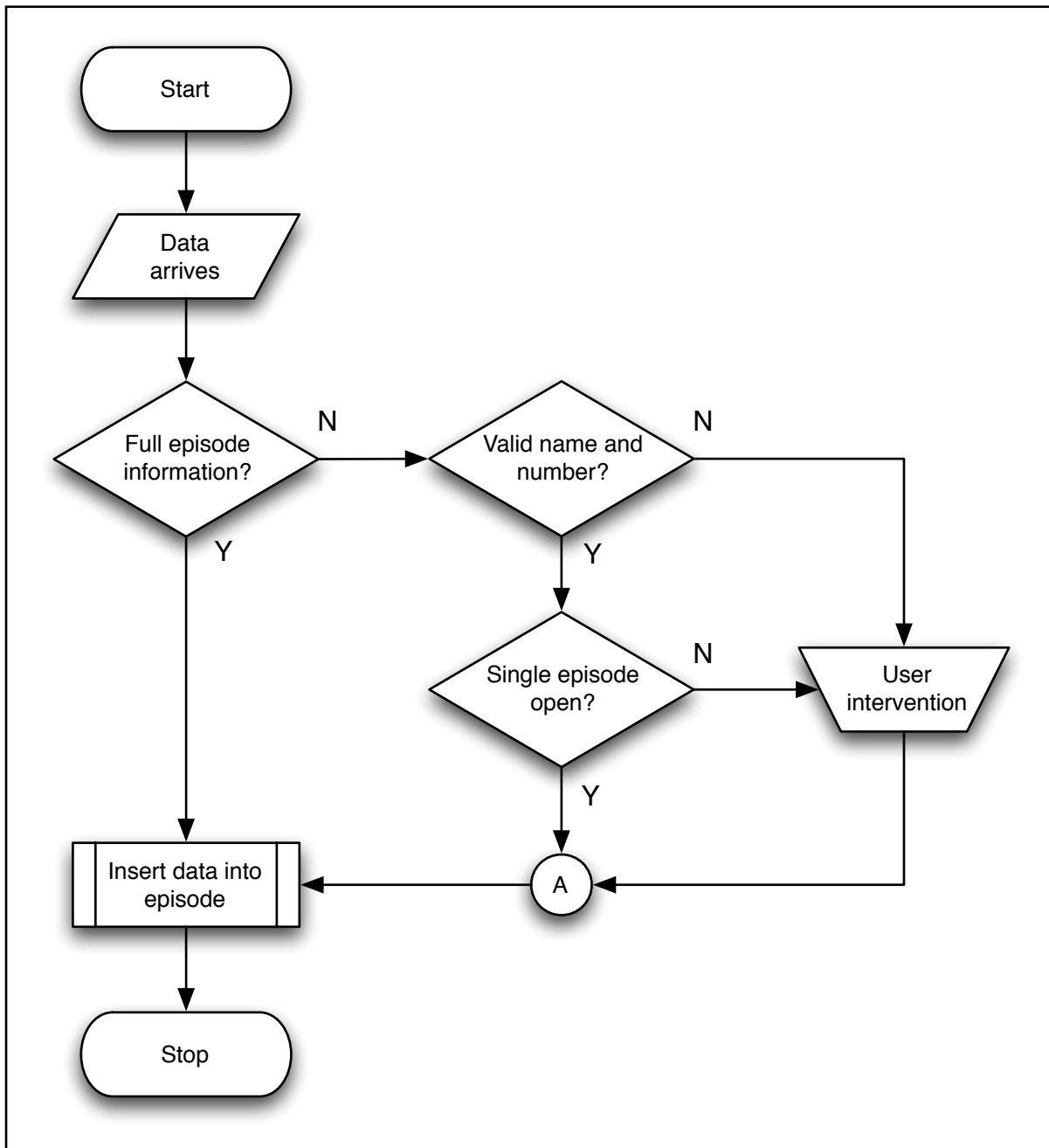


Figure 1. Flow chart for processing of incoming clinical data

Handling of specific data forms

Email

Email is an increasingly used form of communication of clinical data. Unfortunately it often arrives with incomplete patient identifiers, and may be directed to almost any email inbox, where it tends to remain, or is filed or deleted. Nevertheless, it very often contains useful information about the patient which can be helpful in their management, and should therefore appropriately be filed within the notes.



It is proposed to develop a system whereby the recipient of the email can simply forward it to a dedicated address where processing (automatic if possible) can be undertaken to insert the information in the correct place in the electronic record.

Data files

Many imaging devices in ophthalmology are capable of saving files in a predetermined format to a disk drive. Ideally these can be saved directly to a networked drive so that OpenEyes can gain access. Alternatively they can be saved to that location by user intervention. Once in the correct location, the files can be examined by OpenEyes and processed according to the algorithm in figure 1.

HL7 messages

HL7 is a commonly used standard for data interchange between disparate clinical systems. In general HL7 messages contain adequate information to allow automatic processing, particularly if they have arrived as a result of an investigation request. Those messages that do not should at the very least have sufficient information to identify the patient.

User intervention

Incoming data items which are not suitable for automatic insertion into the OpenEyes database (see figure 1) fall into two categories. A scheme for handling data in each of these is described.

1. Valid patient information

Examples of this category would be an incoming letter with full patient details, but user intervention is still required to identify the correct episode to associate the data with. This is analogous to the current process of scrutinising letters in a Choose and Book office. For non-urgent cases, the following workflow is proposed;

User logs on, and goes into patient mode by calling up a particular patient record.

- i. The system detects the presence of unassigned clinical data, checks user permissions, and prompts for intervention.
- ii. If the user response is affirmative, then a new clinical event record of appropriate type is created and presented containing the clinical data. The user can then confirm its validity and save to the record.
- iii. For urgent cases, the above process can be augmented by the addition of a clinical event alert which will prompt the user to deal with the issue.
- iv. For very urgent cases, the above can be further augmented by the sending of an email or text message to the consultant in charge of the patient.

2. Invalid patient information

Examples of this category would include emails, and images with non-corresponding patient names and numbers. By definition this group of data is difficult to deal with. There probably needs to be a clinician (a duty that is rotated) whose responsibility it is to scrutinise such data and make all efforts to assign its storage to the correct location.



Software Components

In order to support the various processes described in the previous section, a number of software components need to be constructed. These would be software daemons (or services on windows) which would do the following;

- Listen on a port for an incoming HL7 message, or watch a directory for an incoming file
- Apply the logic in the flow chart in figure 1, interacting with the PAS when necessary
- Either store the data directly in the OpenEyes database, or store in the 'Pending' area so that the data can be verified by user intervention.
- Optionally send a message to a user for urgent data items

The following diagram illustrates the connections of the various components in this process;

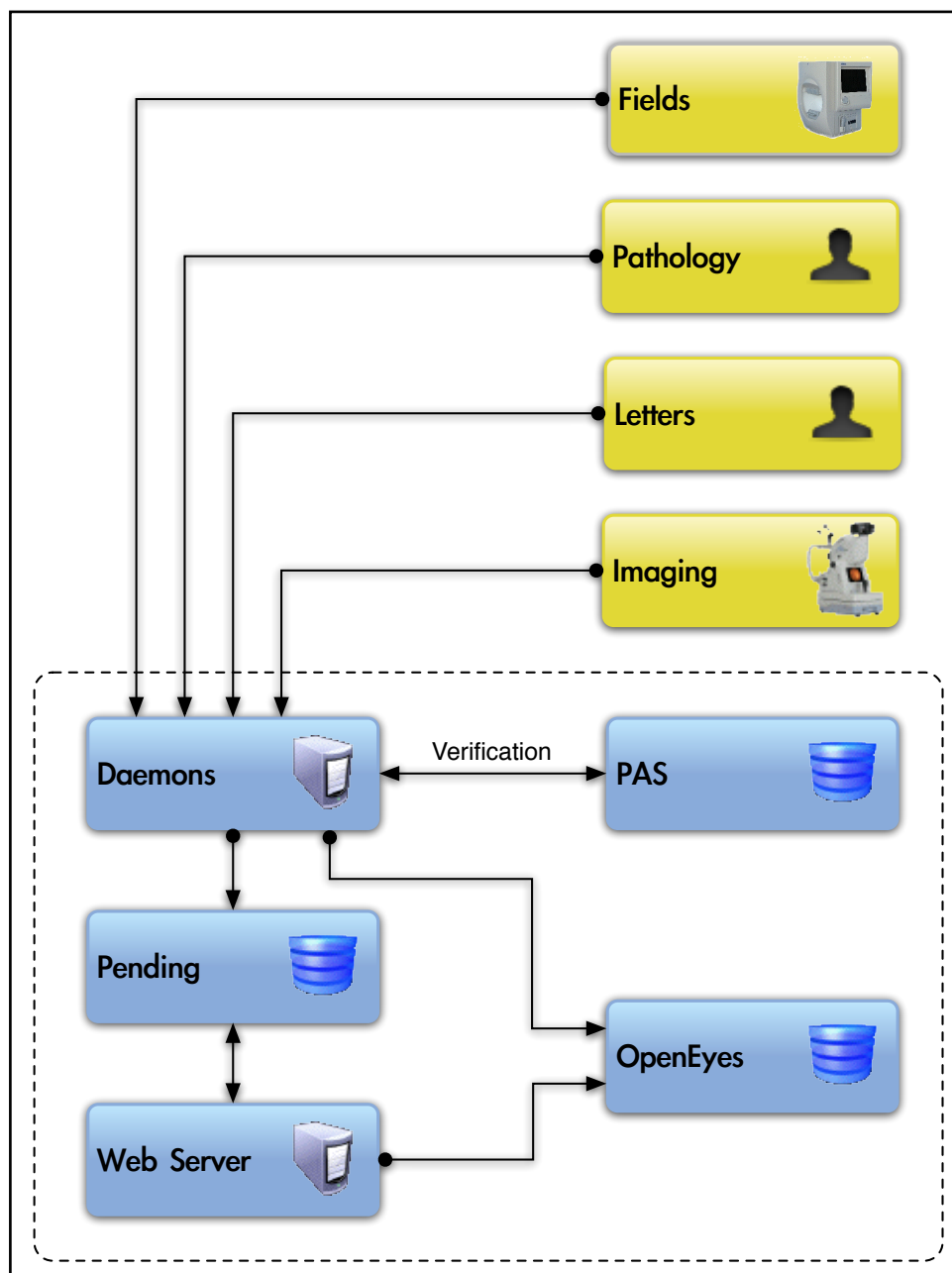
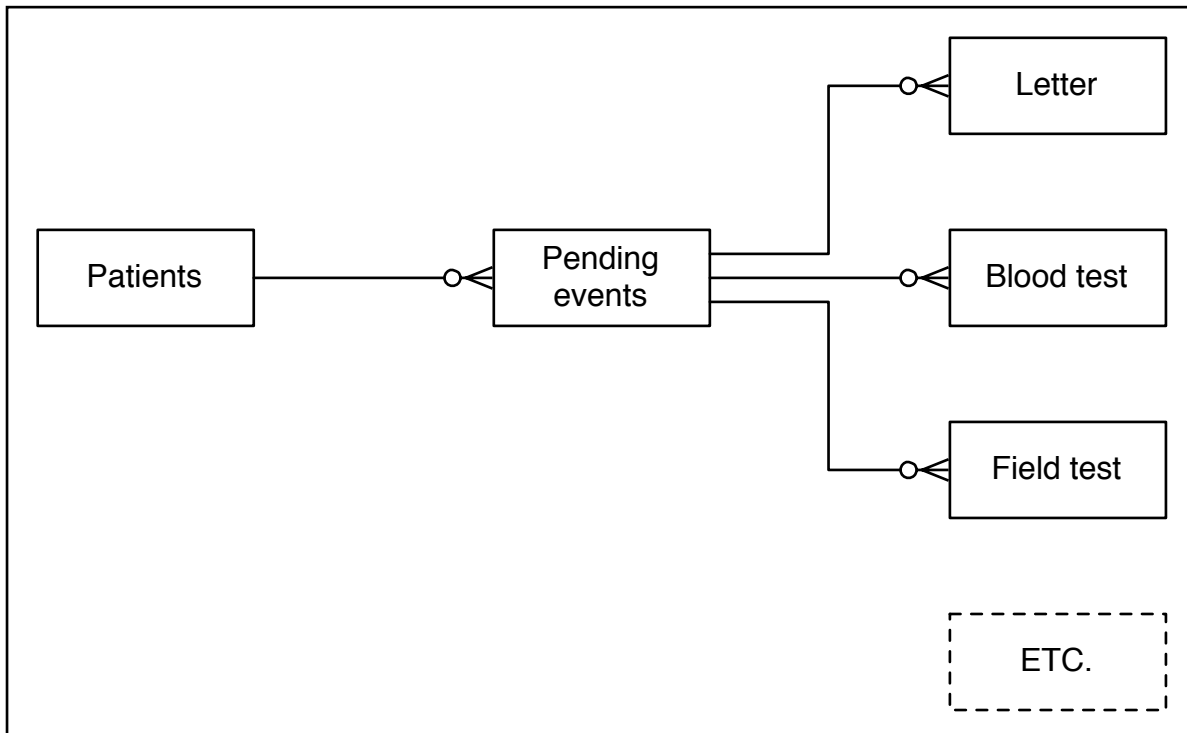




Table Structure

The following entity diagram illustrates the relationship between the various tables. A pending events table stores information about the event including its type. The type corresponds to a clinical event, full details of which are stored in a number of tables which corresponds to the equivalent event table.



References

1. OpenEyes Clinical Events
2. OpenEyes Visual Fields