SLIDA SDK*)

SIDEXIS Software System Integration**)

Version 1.4 (Released)

*) ”*SLIDA*” = **S**oftware **LI**nk for **D**ental **A**pps
) ”*SIDEXIS*" = **SIrona **DE**ntal **X**-ray and **I**maging **S**ystem

History

Version	Date	Author, dept.	Change
1.0	01.03.94	J. Zimmermann, GBE	Draft
1.1	17.05.94	J. Zimmermann, GBE	Card index number and line lengths added
1.1	30.06.94	J. Zimmermann, GBE	Review + approval
1.2	19.07.94	J. Zimmermann, GBE	Reduced character set for external card index number, approval
1.3x	13.11.95	J. Zimmermann, GBE	Extending the concept to an arbitrary number of communication participants (mailslots), image transfer with mail token, automatic image selection and viewer
1.3a	12.12.95	J. Zimmermann, GBE	Explanations for configuration of mailslot concept with illustrations, correction of token "A" image selection
1.3b	08.01.95	J. Zimmermann, GBE	Tokens extended by addresses of senders and receivers; token "U" for unknown patient can no longer be used as "N" + order completion message token "R", restriction of station names
1.3c	16.01.96	J. Zimmermann, GBE	Error correction of mailslot sample hex dumps, uniform terminology
1.3	02.02.96	M. Reinke, GBE	Review + approval
1.31	24.04.96	J. Zimmermann, GBE	Draft of a slimmed down version w/o viewer, token "R"; image ID range unchanged, + image ID wildcard for image overview
1.31	26.04.96	M. Reinke, GBE	Review + approval
1.32	24.05.96	J. Zimmermann, GBE	+ Reference to service manual, blank at the end of external card index no. not allowed
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1.4	16.08.16	J. Zimmermann, GBE	Fixed 8261, 8262, 13090, 13139, 13547, 13940, 14010, 17320, 17321, 17322, 17323, 19414, 20004, 20020, 20142, 20512, 20513, 23091, 23200, 23207, 23447, 23451, 23452, 23462, FR00538, FR01008
1.4	04.10.16	O. Horch, GBE	Review
1.4	06.10.16	J. Zimmermann, GBE	Approval

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1 Introduction

1.1 Motivation and objective

In the dental practice, computer assisted apps such as practice administration, digital X-ray, video, Cerec, teleradiographic analysis, multimedia apps etc. are beginning to contribute towards saving costs, quality control and optimization of operations. The vision of the practice without card index has also come within reach in this innovative area. Separate special apps suited to the relevant sphere of work are the best way to fulfil the customers' desire for equipment stability, data protection and ergonomics.

When these different apps are integrated into a computer system with several workstations installed in the practice, attention must be paid to user friendliness and coordination of the working processes. Customers' wishes such as avoiding multiple inputs, adaptability of the individual apps to the relevant situation from the small practice up to the large clinic, object-specific standardized processing of the individual data objects, reliability of the apps and integration even beyond system boundaries must be taken into account. In addition, the requirements of the European medical device legislation must be observed.

Possible concepts must pay particular attention to the different operating modes of the communicating apps (e.g. the SIDEXIS app producing X-ray and video images and the practice or hospital management system): The practice management system, abbreviated to "PM" in the following, processes mainly text data and for this reason frequently has a text-oriented structure or runs under a non-graphics operating system. SIDEXIS has been designed for the production, viewing and processing of digital X-ray and video images of every type and accordingly runs under a graphics user interface. SIDEXIS on its own is already capable of multiple use, but it is not able to import data from the existing patient base of PM and also does not account for the images produced.

The following mailslot concept was implemented for the full integration of all current computer assisted apps into the overall system:

In the given situation (e.g. within PM), the dentist enters an X-ray order f.ex. in the form of a message (i.e. a text line) in a mailslot (i.e. in a file). This order is accepted and fulfilled where the image should or can be produced. After completing the diagnosis, the results can be recorded automatically by the PM. The question whether diagnosis was performed on the part of the ordering or on the part of the executing staff is of no significance. In this case the order is expressly authorized by the user.

The solution presented here fulfils the above mentioned requirements:

- The automatic transfer of patient data avoids double entries

- The message to the PM concerning the images produced guarantees automatic recording and accounting for work done

- The data objects, i.e. images and accounts, are separated according to type and working environment and edited on their appropriate interface

- The apps involved can run simultaneously on the same computer if this is compatible with the operating system. It is then possible to switch over between apps within fractions of a second (also automated)

- The user can choose between a closer and a less close cooperation between the apps, and the degree of integration can be adapted to the relevant working routines

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Due to separate storage of the X-ray data, standby operation of SIDEXIS is also possible on failure of PM. The individual integrated systems therefore remain autonomous despite their close cooperation and continue to be responsible for their own data.

With SIDEXIS as image-producing app and its integration with other apps, the customer has a tool with which he can make use of all advantages of digital X-ray, including administrative duties.

The interface description was in fact produced focusing on SIDEXIS but can be transferred to other apps without difficulty.

1.2 Overview

At first the use cases are introduced. Following is a description of the basic concept with a reference to the OSI layer model. The main part is formed by the token reference and the data lexicon. Chapters dealing with configuration and error issues and questions & answers shall be of help for developers.

2 Use cases

The subsequent figure shows the different use cases which have to be tackled:

Receiver

Transfer new patient

Place creation order

Start/activate app

Open patient (folder)

Open image

Update data

Send image

SLIDA mailslot occupied
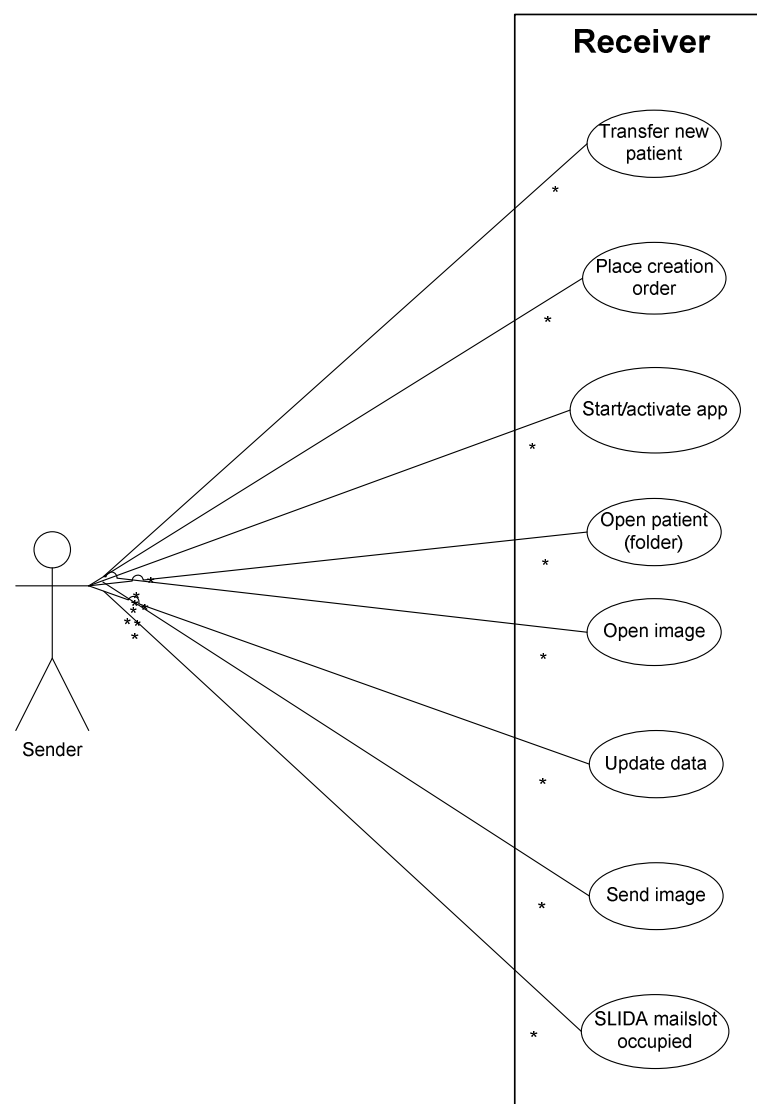
Sender

- "Transfer new patient data": It must be possible to transfer patient data from sending to receiving app.

- "Place creation order": The sender commands the receiver to prepare for creation of an X-ray exposure/image/3D volume/…

- "Start/activate app": The sender tells the receiver's app to start or to activate itself.

- "Open patient (folder)": The sender commands the receiver to open a certain patient or patient folder, respectively.

- "Open image": The sender knows that the receiver holds a certain image/3D volume/…

- "Update data": Since certain data will be kept in both sides' databases, corresponding changes in the source database (patient or image/3D volume/…) must be communicated in order to keep both sides synchronous.

- "Send image": The sender transfers a certain image/3D volume/… in its database to the receiver.

- "SLIDA mailslot occupied": The last use case deals with the situation that the communication between sender and receiver is temporary blocked.

Subsequently the use cases and the corresponding action on the receiver's side are described in detail.

2.1 General use cases

2.1.1 Start/activate app

This is one of the main use cases and one of the main features, even if no data exchange at all in involved: If running on the same target client, the sending app wants to start the receiving one if it is not already running. This is a normal execution call. On getting activated, the receiving app shall check its own mailslot - if any - for incoming messages and process them accordingly.

In order to prevent a "window inflation" before starting the receiver's app, the sender's app should check whether the receiver is already running. In that case the sender should activate the running process rather than start another one. On the other hand a receiving app should control its own starting routine and – if only 1 running process is allowed – it should rather activate the already running one and terminate the 2nd.

If the receiver is able to process SLIDA messages the sender can command the receiver to open a certain patient/image. See use cases Transfer new patient, Open patient (folder), Including app start/activation + opening patient (folder), Including app start/activation + opening patient (folder) or Open image, respectively.

As is always the case with "N" tokens, if the sender is not quite sure whether the receiver has got the correct patient demographics and ext. card-index numbers, the sender should send an additional token "U".

=> Tokens [„N"] [+ „U"]

2.1.2 Update data

On being activated (Task switch), the receiver shall process all data-related token messages present in its mailslot – at least as far as data currently being displayed.

For all patients being displayed: All messages updating those patients' data.

For all images being displayed: All messages updating those images' secondary data.

As soon as the receiver wants to show also the latest imported patient/image data as well: All messages concerning this kind of data.

=> Token „U" [| „N"] [| „I"] [| „M"]

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2.1.3 SLIDA mailslot occupied

Since sender and receiver may try to read/write the receiver's mailslot file at the same time, they both must be able to react to that case. An app finding an occupied mailslot should inform the user about that case and offer a couple of retries.

2.2 Patient-related use cases

2.2.1 Transfer new patient

Main use case for patients. Since the receiver may keep a persistent record of a patient it must check whether it is really a "new" patient or just an update for one already existing in its database.

=> Tokens „N" [+ „U"]

2.2.2 Update patient

Since both sides may keep a persistent record of patients, this is the ay how to transmit changed patient data to the receiver.

=> Token „U"

2.2.3 Open patient (folder)

Command from sender to receiver to open a certain patient or its data folder at a certain client station.

If the patient to be opened is not the currently open one, it is up to the receiver what to do, f.ex. ask the user about closing the current one, placing "Save...?" questions and so on. If the user cancels closing the currently open patient, the command to open another patient shall be discarded.

=> Tokens "N" [+ "U"] + "A"

2.2.3.1 Implicit data updates

All messages with patient demographics fields for identification may update the patient identified implicitly: As long as it is possible to identify a patient via a part of the given data, like ext. card-indexno., f.ex., the rest of the data shall be updated automatically.

=> Tokens "A" | "S" | "X"

2.2.4 Signal new/updated patient

In case the leading system (as far as patient-related data are concerned) is down it must be possible to acquire new medical images nonetheless. In this emergency case the acquiring system is responsible for sending patient data newly entered/changed to the mailslot of the leading system. As soon as the leading system is up again it can process these patients by f.ex. assigning the correct ext. card-index number.

=> Tokens „N" | „U"

2.3 Image-related use cases

2.3.1 Place creation order

Adds the order to create a new image/3D volume/... for a certain patient to the receiver's worklist.

=> Tokens "N" [+ "U"] + "X"

2.3.1.1 Including app start/activation + opening patient (folder)

The receiving app can be implemented in such a way that during activation it looks for an order for the patient to be activated and immediately prepares for this order, f.ex. by allotting an available device to it.

=> Tokens "N" [+ "U"] + "X" + "A"

2.3.2 Send image

The use case to send a certain image/3D volume/... of a patient to a receiver can occur in 2 ways, depending on the sender's possibilities and configuration: Automatically or manually by f.ex. letting the user push a corresponding button. This is a rather asynchronous use case. It even allows for defining the receiver's mailslot to reside on a remote disk or on a removable medium like a USB memory stick which - after change of the geographic location, f.ex. from practice to home office – at another location acts as the receiver's incoming mailslot in order to exchange data to be imported into another system elsewhere.

=> Tokens „N" + „M"

2.3.2.1 Including app start/activation + opening patient (folder)

This applies only to the non-automatic option. If the receiving app can be started and is started or activated, respectively, the sender (if found appropriate) can command the receiver additionally to open the corresponding patient after its update/new registration on the receiver's side. The receiver may additionally look for images waiting (Token "M") for automatic or manual import and decide to open them additionally after the import process has finished. In contrast to the preceding use case this one could be called a synchronous use case.

=> Tokens „N" + „M" + „A"

2.3.3 Update (secondary) image data

The app where secondary image data like tooth designation, dose values, diagnosis etc. are updated shall broadcast those changes to all apps that want to obtain tis information. This may not only be the case for post-processing apps but mainly for accounting apps.

=> Token „I"

2.3.4 Open image

If the receiver-internal ID of a certain image/3D volume/… is made known the sender (F.ex. by looking for and recording "T" tokens sent by the receiver before) the sender can command the receiver to open this record automatically, f.ex. for review. As an alternative it is possible to open a complete or partial patient folder containing this patient's records. In the latter case knowledge of record IDs is not necessary on the sender's side.

=> Token „A"

3 Basic concept

3.1 Information exchange

3.1.1 The mailslot concept

Communication between the individual apps is based on the reciprocal writing and reading of files, the "mailslots". This enables communication independent of the operating system, because common access to all files of a DOS drive is possible in all relevant operating systems. The mailslots are then located on a drive jointly accessible to the communicating apps. Here it is immaterial whether this drive and the apps are available in a single device (single station operation) or whether it is a question of an installation in a homogeneous or heterogeneous network (multiple station operation). The functionality of the relevant user interface is completely maintained.
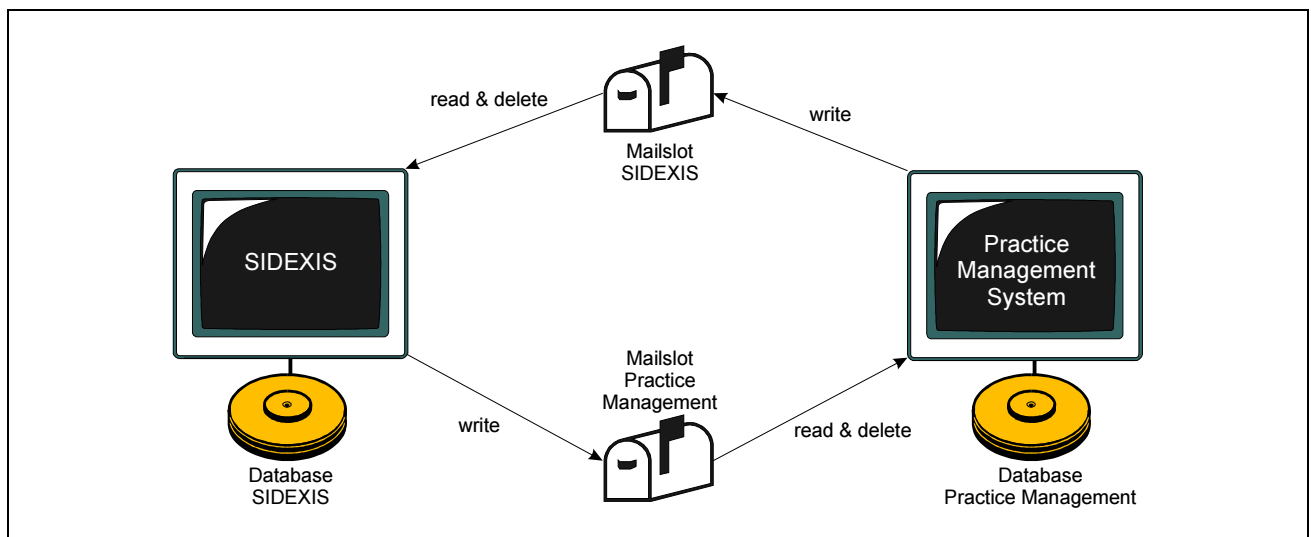
Communication between single station installations

Each application class to be integrated in the system has its own mailslot. The messages in the mailslots are made as line entries. Each message defines a complete request for an action or contains information which is complete in itself. The information flow is always only in one direction. The role of sender and receiver is thus clearly defined. The sender places individual messages in the corresponding mailslot. The receiver reads these messages and deletes them after having processed them. If the receiver does not process the messages, it must also delete them so that the mailslots are not unnecessarily overburdened.
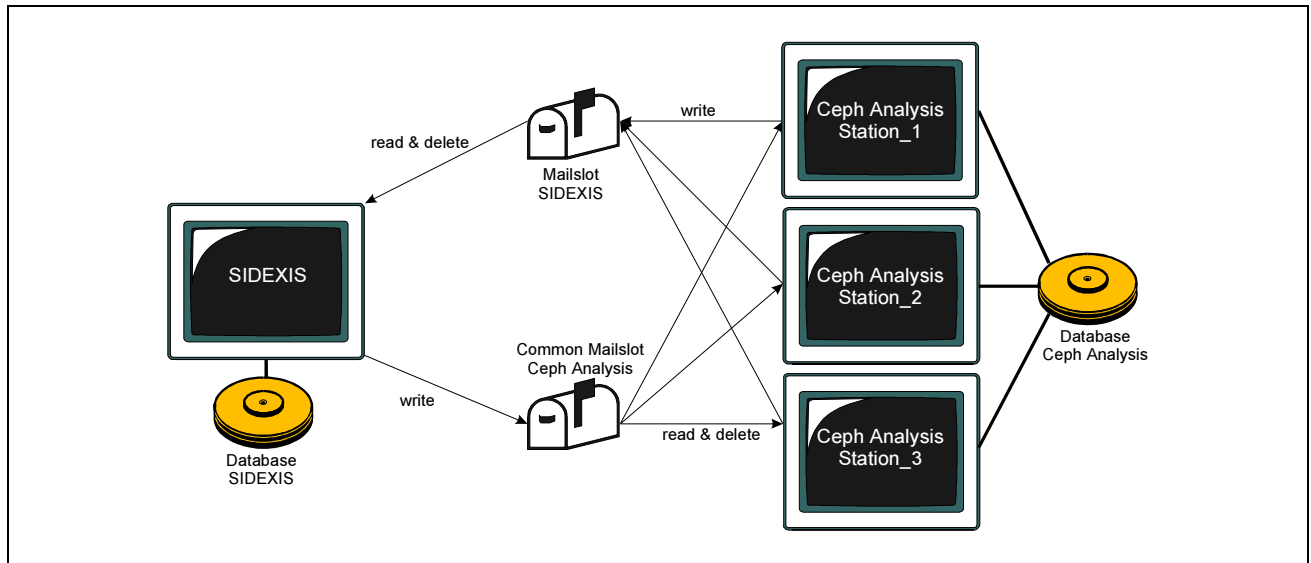
Communication between single/multiple user installation

3.2 Processing responsibility

Each receiver is responsible for the processing of data arriving in its own mailslot. A message must not be deleted on account of temporary technical problems, like f.ex. currently inavailable database services. This is important since otherwise a complete and fault-tolerant data flow cannot be guaranteed.

If a receiver empties its mailslot before processing part of or all its messages and moves them to another place it must be technically at least as safe as the mailslot file itself since otherwise senders cannot rely on the fact that a removed message from there means that it has been processed correctly and only was rejected if a real syntactic or semantic error occurred.

This of course applies also to the case when a receiver decides to not process messages in a strictly FIFO order (See below).

3.3 Possible functional extent / Who does what

The following table shows the functional extent covered with the mailslot concept. The different application classes require in each case only a part of the possible functions. Entries in brackets indicate a possible, but not necessary function.

Function	Image-producing apps, e.g. SIDEXIS	Practice management system apps ("PM")	Image post-processing apps, e.g. teleradiographic analysis, cosmetic dentistry, implant planning
Accept patient data	(send)	send	(send)
	receive	(receive)	Receive
Order: Produce image	-	send	Send
	receive	-	-
Reply that order is completed	send	-	-
	-	receive	Receive
Message that the image was produced	send	-	-
	-	receive	-
Accept supplementary image data	send	(send)	-
	(receive)	receive	-
Order: Automatically open patient or image overview	-	send	Send
	receive	-	receive
Accept image	send	-	-
	-	-	Receive

4 OSI 7-layer model

To fit into a well-known scheme in order to facilitate understanding, this chapter tries to describe the SLIDA mailslot concept as compared to the OSI 7-layer model:

UPPER LAYERS	7	**Application Layer** ✓ Message format, Human-Machine Interfaces
	6	**Presentation Layer** ✓ Coding into 1s and 0s; encryption, compression
	5	**Session Layer** ✓ Authentication, permissions, session restoration
TRANSPORT SERVICE	4	**Transport Layer** ✓ End-to-end error control
	3	**Network Layer** ✓ Network addressing; routing or switching
	2	**Data Link Layer** ✓ Error detection, flow control on physical link
	1	**Physical Layer** ✓ Bit stream: physical medium, method of representing bits

4.1 Bottom layers

From bottom to top, the **Physical Layer** of the concept is the file system medium, like hard disk, RAM disk and so on.

The **Data Link Layer** is provided by the operating system's file system mechanisms.

If the mailslot file resides on a network drive, there is a corresponding **Network Layer** present.

There is no end-to-end error control like defined in the **Transport Layer**. Error handling depends on appropriate reaction of the participating apps on file I/O errors.

4.2 Session Layer

The mailslot files are processed according to the FIFO principle. This means that new messages are appended to the end of the file; processing starts at the beginning of the file provided the type of message allows this. A processed message is deleted from the mailslot. On the occurrence of errors, the current message is also deleted and processing continues with the next message.
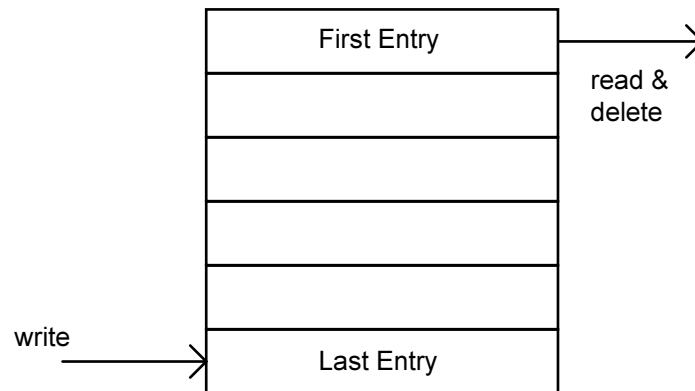
To limit the length of the mailslot files, ignored messages must also be deleted. These are for instance changes of diagnosis in SIDEXIS which were made by PM only after completion of acquisition and can no longer be accounted for or non-executed orders from the previous day.

4.3 Presentation Layer

There is neither encryption nor compression applied - except as defined transparently by the file system itself.

4.3.1 Mailslot structure

The mailslot files have the following format in common:

The format of the mailslots is line oriented. Each line defines a request or information which is complete in itself and is designated as **message** in the following.

Messages always start with the statement of their length ('0000' - 'FFFF' Hex) as a 2 byte long binary value (i.e. not as a string) in the Intel notation (LSB first). This length statement serves for quickly searching through the mailslot and reducing dependencies on version, since in this way the length of a new message does not have to be known. The total length of the message including the leading length statement and the concluding carriage return (see below) must be stated in each case as a length.

The length statement is followed by a string consisting of one character (designated as **token** in the following), which designates the message more closely. This **token** at the same time determines the information that follows it.

The remainder of the message consists of a series of strings (including string end marks) which are designated **data fields** in the following. An empty data field is accordingly identified by a single 0 byte.

The end of the message is defined by the implicit statement of the expected data fields in the **token** and, for reasons of better legibility, it is identified additionally by an ASCII carriage return (0x0D + 0x0A). (If there are some bytes left in between the last field to be processed and this carriage return these bytes are to be ignored.)

A message should contain as many data as are required to process an action or information which is complete in itself. For example, every image information message must contain patient data for identification, or all patient data must be stated for patient-related requests (New/Change).

4.3.2 Nomenclature of the mailslots

Since the mailslots are assigned to the relevant apps, they should contain their names. The file extension is defined as "sdx".

Example: Name of the mailslot file of SIDEXIS = "sidexis.sdx".

Because of the possibility of differentiating set names from one another, the existing mailslots can be filed jointly in one directory. However, filing in different directories is also possible.

4.3.3 Examples of the mailslot layout

4.3.3.1 Mailslot file for SIDEXIS, sidexis.sdx

In this example, app "PM" sends patient data and an image production order to SIDEXIS.

```
 Offset   00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F   0123456789ABCDEF

-------- ------------------------------------------------   ----------------

00000000 4A 00 4E 00 53 63 68 6D 69 64 74 00 41 6C 66 72   J.N.Schmidt.Alfr
00000010 65 64 00 30 31 2E 30 37 2E 31 39 35 33 00 31 30   ed.01.07.1953.10
00000020 30 31 00 4D 00 44 6F 72 66 6E 65 72 00 5C 5C 53   01.M.Dorfner.\\S
00000030 74 61 74 69 6F 6E 5F 31 5C 50 4D 00 5C 5C 2A 5C   tation_1\PM.\\*\
00000040 53 49 44 45 58 49 53 00 0D 0A 73 00 58 00 31 31   SIDEXIS...s.X.11
00000050 30 30 32 00 53 63 68 6D 69 64 74 00 41 6C 66 72   002.Schmidt.Alfr
00000060 65 64 00 30 31 2E 30 37 2E 31 39 35 33 00 31 30   ed.01.07.1953.10
00000070 30 31 00 4D 00 4E 00 34 36 58 49 00 43 68 65 63   01.M.N.46XI.Chec
00000080 6B 00 53 74 61 74 69 6F 6E 5F 31 00 31 38 2E 30   k.Station_1.18.0
00000090 35 2E 31 39 39 34 00 31 33 3A 34 30 3A 30 30 00   5.1994.13:40:00.
000000A0 5C 5C 53 74 61 74 69 6F 6E 5F 31 5C 50 4D 00 5C   \\Station_1\PM.\
000000B0 5C 2A 5C 53 49 44 45 58 49 53 00 0D 0A            \*\SIDEXIS...
```

The receiver will perform the following actions after activation or call-up of the patient selection:

1. Open sidexis.sdx
2. Add Schmidt, Alfred if not yet known, otherwise identify through external card index number, check for data changes and if necessary update (message "N")
3. Mark Schmidt, Alfred for preselection (message "X")
4. Delete message "N" from sidexis.sdx
5. Close sidexis.sdx

After call-up of order acceptance for Schmidt, Alfred:

1. Open sidexis.sdx
2. Display information for this order (message "X")

After acceptance of the order:

1. Delete message "X" from siomin.sdx
2. Close sidexis.sdx
3. Take over order data and go into readiness for exposure

4.3.3.2 Mailslot file for a PM system named "PM", pm.sdx

This example refers to the previous one. Directly after the image is produced, the associated "T" message is sent. Diagnosis of the image creates message "I".

```
 Offset   00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F   0123456789ABCDEF
--------  -----------------------------------------------   ----------------
00000000  7C 00 54 00 31 31 30 30 32 00 53 63 68 6D 69 64   |.T.11002.Schmid
00000010  74 00 41 6C 66 72 65 64 00 30 31 2E 30 37 2E 31   t.Alfred.01.07.1
00000020  39 35 33 00 31 30 30 31 00 31 00 4D 00 4E 00 34   953.1001.1.M.N.4
00000030  36 58 49 00 31 38 2E 30 35 2E 31 39 39 34 00 31   6XI.18.05.1994.1
00000040  33 3A 35 30 3A 30 30 00 44 6F 72 66 6E 65 72 00   3:50:00.Dorfner.
00000050  43 68 65 63 6B 00 00 35 30 00 37 30 00 37 00 5C   Check..50.70.7.\
00000060  5C 53 74 61 74 69 6F 6E 5F 32 5C 53 49 44 45 58   \Station_2\SIDEX
00000070  49 53 00 5C 5C 2A 5C 50 4D 00 0D 0A 74 00 49 00   IS.\\*\PM...t.I.
00000080  53 63 68 6D 69 64 74 00 41 6C 66 72 65 64 00 30   Schmidt.Alfred.0
00000090  31 2E 30 37 2E 31 39 35 33 00 31 30 30 31 00 31   1.07.1953.1001.1
000000A0  00 34 36 58 49 00 31 38 2E 30 35 2E 31 39 39 34   .46XI.18.05.1994
000000B0  00 31 33 3A 35 30 3A 30 30 00 44 6F 72 66 6E 65   .13:50:00.Dorfne
000000C0  72 00 43 68 65 63 6B 00 4F 4B 00 35 30 00 37 30   r.Check.OK.50.70
000000D0  00 37 00 5C 5C 53 74 61 74 69 6F 6E 5F 32 5C 53   .7.\\Station_2\S
000000E0  49 44 45 58 49 53 00 5C 5C 2A 5C 50 4D 00 0D 0A   IDEXIS.\\*\PM...
```

PM performs the following actions:

1. Open pm.sdx
2. Look for "T" message for the order number, note image number(s)
3. Read "I" message for the image number, group data order-related and transfer into record of services and possibly into the own X-ray control book
4. Delete all processed messages from pm.sdx
5. Close pm.sdx

4.4 Applicaton Layer

4.4.1 App level error handling

An exchange of error messages such as "<Application> cannot add new patient" or "<Application> cannot save reported data" is not intended.

4.4.2 Token messages

The meaning and sequence of the data fields within a message follows from the information on the individual tokens provided in chapterReference.

4.4.3 Data fields

If the field lengths differ for individual pieces of information, the receiver accepts the data from the left as far as possible and rejects the rest if its available field length is shorter. The lengths of the names were selected so large in consideration of international compatibility. Special features of the German market are relevant only if they necessitate the fields to be lengthened.

All data (also numbers) are converted for transfer into character strings with standard C string end marking (0 byte at the end). The data, sex and image type have fixed lengths in this case. All other

data have variable lengths. A collection of the data with information on maximum lengths is provided at the end of this description.

Since umlauts and special characters of national languages should be allowed and these characters must be unambiguous (names can be identification keys), they must be contained in the set of possible characters. It was therefore specified that characters must originate from the so-called DOS extended ASCII character set.

4.4.3.1 Patient-related data

An external card index number made available by the PM serves as key for patient identification within the messages. This is then unambiguous throughout the system, i.e. over all integrated apps. If the PM does not support such an unambiguous card index number or if no PM is integrated in the system, then in the case of an empty external card index number, identification is made through the combination of name / first name / date of birth[*) of the patient.

If unambiguous external card index numbers are allocated within the PM, then these can serve to identify patients. Even if the external card index number is used, the name, first name and date of birth must be stated for counterchecks and adaptations in the messages, in order to be able to interpret changes of the data correctly.

To keep the patient-related data in the communicating systems consistent with regard to the patient-related information and external card index number, it is recommended to accept the data of the newly added patient directly from the PM whenever this is possible. In addition, regular revision of the reported data changes is necessary.

Even in fully automated practice operation, initial faulty entries can still occur. Changes of names and also of dates of birth can therefore be expected. To keep the expense of adaptation low, the receiver automatically makes changes to the most important patient-related data (name, first name, date of birth) for some messages, if it detects these. A prerequisite for this is that the patient can be identified unambiguously by reference to the external card index number.

As long as the external card index no. is not defined as uniquely identifying a patient in the receiving app, patients whose combinations of name, first name and date of birth are identical are not allowed, i.e. identification via the external card index no. plays no part in this case.

[*) Advanced apps like SIDEXIS 4 may be able to tolerate a missing date of birth. In this case provision of an unambiguous ext. card-index no. by the sending app is obligatory to identify a patient.

4.4.3.2 Image/volume-related data

SIDEXIS always administers the types of images in intraoral X-ray and video apps so that these are assigned to a single tooth (e.g. 41XI for an intraoral X-ray of tooth 41, "XI" = "X-Ray Intraoral"). Although several teeth may be displayed on one image, one image is always assigned unambiguously to one tooth. An order for a row of teeth must therefore be split into several orders for the desired single teeth, e.g. for an X-ray image for the teeth 41 to 43 into 3 orders for "41XI", "42XI" and "43XI". It is then possible to decide locally in the image-producing app which and how many images are required by reference to an overview of the images that are required of the patient.

An unambiguous order number must be assigned to every order for an image. Any information pertaining to these orders will refer to this order number.

Every image is assigned an unambiguous image number for this patient, which is used in the further course as unambiguous reference in connection with the external card index number of the patient (or of his/her data). The order number is then no longer required and accordingly deleted after the order has been processed. The image numbers reported by SIDEXIS to other apps lie in

the range of 1 - 9,999. To obtain unambiguous image numbers through the system for several different image-producing apps (for the patient in question), these must work in different number ranges provided they also use the mailslot concept described here.

As response to an order, SIDEXIS does not deliver the number of images produced, but a separate data record for each image produced. The number of the images produced in total then results in combination with the order number. This procedure is justified by the fact that the production of an X-ray image represents a self-contained action which must be handled autonomously (also for security reasons). The last order number is always retained until the patient logs out or a new order is accepted or until the user declares the order as completed.

However, all orders do not have to be fulfilled individually, because one image can also cover several orders. In the above example ("41-43"), there could be only 2 return messages for the 3 orders placed, if for instance the teeth 41 and 42 can be seen on the first image and the teeth 43 and 44 on the second. In contrast to this, several replies can also appear with the same order number, if several images were necessary for this, e.g. in an order for producing a status.

Under certain circumstances, SIDEXIS initially returns many undiagnosed images, since it does not force the user to diagnose or reject an image which has just been produced. The messages concerning image production and diagnosis are sent in each case separately directly after performance of the corresponding action. However, it can be expected as a rule that diagnosis is made in the same session.

4.4.3.3 Administrative information

In certain actions such as patient selection and X-ray order, the name of the calling workstation is transmitted in addition, in order to simplify telephone enquiries in the case of multi-user systems or to allocate priorities. It has also proven to be advantageous to state the date and time of initiation of an action as well.

4.4.4 Example of communication

The following example shows the typical course of a communication between PM and SIDEXIS (w=write, r=read):

Token PM		Token SIDEXIS		Action
w	r	w	r	
N				**Request**: Add new patient, external card index No. 3314
X				**Request**: Produce image 41XI, Order ID 52465
X				**Request**: Produce image 42XI, Order ID 52466
			N	**Processing**: Adds patient 3314
			X	**Processing**: Order 52465 facilitates pre-selection of patient 3314 => User: register patient 3314, accept order 52465
		T		**Message**: After producing image by user for order 52465, image ID 10001
			X	**Processing**: Display order 52466 => User: Accept order 52466
		T		**Message**: After producing image by user for order 52466, image ID 10002
		I		**Message**: After diagnosis by user info on image 10001
		I		**Message**: After diagnosis by user info on image 10002
	T			**Processing**: Store new image for order 52465 => image ID
	I			**Processing**: Diagnosis for image 10001 => Accounting
	T			**Processing**: Store new image for order 52466 => image ID
	I			**Processing**: Diagnosis for image 10002 => Accounting

5 Reference

A description of the possible message with their tokens and data fields follows.

The data marked with (*) can also be left out optionally on transmission. This means that these data are not present (blank) or have remained unchanged.

Examples are described using PM and SIDEXIS as sender and receiver or vice-versa.

5.1 Token "A": AutoSelectPatient / automatic patient/image selection

This token activates a patient and optionally an image of this patient without the user having to do anything. Automatic patient selection occurs on activation of the app concerned (e.g. by task switch from PM to SIDEXIS). In case of several "A" messages, the first is processed in each case. Further "A" messages are retained for later activation. It is the responsibility of the sender to ensure that the patient to be selected is already known by the receiver, i.e. before "A" for a patient, an "N" should have been sent at least once on this patient in the past. In the case of identification using the external card index number, the other patient data can be updated automatically.

According to which app appears more logical in the current context, there can be a task switch to SIDEXIS (sidexis.exe) in this case. Which of the two apps processes the token depends upon which app was activated first. This can be determined by the calling app in Windows systems.

Expected data fields / Identification:

1. Name of patient
2. First name of patient
3. Date of birth
4. External card index number

Expected data fields / Information:

1. Station name of the calling station
2. Date of call
3. Time of call
4. Address of sender
5. Address of receiver

Expected data fields / Identification:

1. Image number (optional), 0 for image selection

Expires: Such a token message is to be deleted automatically from the receiver's mailslot by the receiver if older than 24 hours.

Example:

Process	Action
User	Requests in the patient history of PM the display of an image entered there
PM	Writes "A" message into SIDEXIS mailslot and performs task switch to SIDEXIS
SIDEXIS	Examines its own mailslot after activation and activates the patient. If an image number is found, then the associated image, or for 0 an image selection, is automatically opened

5.2 Token "I": Information / Changing supplementary image data

Changes to the image information are reported by this token to the receiver at a later point in time (such as a subsequent diagnosis). Here data which have not been changed can be left out during the transfer. Stating only one value is not permitted for image date and time (both or no statement). Except for the reason, which is not stored permanently, SIDEXIS always delivers all values, also those which have not changed.

In the case of images relocated by SIDEXIS (long-term archiving), the message is not processed and it is deleted in the mailslot.

Orders can result in several images, i.e. if a status has to be produced. Since SIDEXIS currently does not combine images, every individual image can be assigned a diagnosis by the user. Since the requesting app (e.g. PM) knows the relation between image and order, it can collect the individual diagnoses and combine them into a total diagnosis for this order. It is at the discretion of the PM (or its user) whether a diagnosis must be available for every single image for accounting for the image(s) or whether it is sufficient if at least one image of the relevant order was provided with a diagnosis. If a (further) diagnosis appears to be necessary, then this can be done both in SIDEXIS and in PM.

All data changes which are performed by PM should be reported to SIDEXIS by "I" message for reasons of consistency. As reciprocation, every diagnosis in SIDEXIS must result in an "I" message in the PM mailslot. If several "I" messages are present in the mailslot for one image, then only the last message applies, provided this contains all information completely. On the other hand, if information was left out there, then all "I" messages must be processed in chronological order.

SIDEXIS cannot provide the number of images to be accounted for any more than it can the number of images produced. This is relevant only for accounting (also not for the X-ray control book) and therefore does not represent a requirement to be fulfilled by SIDEXIS. However, the reference to the diagnosis represents an indirect statement on accountability: Diagnosed images, i.e. images for which a non-empty diagnosis text was returned by SIDEXIS, could be viewed as diagnosed and thus as accountable. Then only the undiagnosed images, which then can still be processed subsequently in PM, are left over.

Serving as a further clue as to whether images that have been produced have to be accounted for, it is possible to mark images as not accountable. A double '~' symbol then appears at the beginning of the image type field in the associated messages, e.g. "~~XI".

Expected data fields / Identification:

1. Name of patient
2. First name of patient
3. Date of birth
4. External card index number
5. Image number

Expected data fields / Information:

1. Image type (*)
2. Date of image (*)
3. Time of image (*)
4. Person in charge (*)
5. Reason/Notes (*)
6. Diagnosis (*)
7. Radiation duration (*)
8. Tube voltage (*)
9. Tube current (*)
10. Address of sender
11. Address of receiver

Example:

Process	Action
User	Opens an image in SIDEXIS and changes the diagnosis for this
SIDEXIS	Writes "I" message into PM mailslot
PM	Reads "I" message, if necessary initiates accounting for the services

5.3 Token "M": Mail / Image/volume transfer

Transfers an 2D image/3D volume to another app for further processing. If a patient with the stated data does not yet exist in the database of the addressed app, then this patient must firstly be newly added ("N" message).

Accepted 2D image file formats: TIFF, BMP, JPEG (JPEG2000 excluded).

Accepted 3D volume file formats: DICOMDIR, *.dcm.

The 2D image will always be stored in the same directory as the mailslot of the receiver. If the image file is no longer required, this must be deleted (as is also customary for the messages in the mailslot). A reference to the transferred image is provided by the image number in conjunction with the patient identification. Double transfers are prevented in this way.

3D volumes are to be stored in a subdirectory to the mailslot's directory. This subdirectory's name is given in the token message instead of the image file name in the 2D case.

Note that, in contrast to the file name mentioned in the sdx file, the file name of the image file/subdirectory itself has to be coded in ANSI rather than in DOS-extended ASCII!

Expected data fields / Identification:

1. Name of patient
2. First name of patient
3. Date of birth
4. External card index number

Expected data fields / Information:

1. Image type
2. Date of image
3. Time of image
4. Person in charge
5. Image file name (2D) / subdirectory name (3D) without path
6. Address of sender
7. Address of receiver

Expected data fields / Identification / Addition:

1. Image/volume number

Note: Certain image/volume formats like may contain describing data, like image creation timestamp in TIFF and JPEG f.ex., or even patient demographics in DICOM. If the information given there differs from the information given in the token fields, an receiving app should use the information in the token fields.

Example:

Process	Action
User	Sends an image for teleradiographic analysis (e.g. by switch or command in SIDEXIS)
SIDEXIS	Writes image file into the directory in which the teleradiographic analysis mailslot is located, as well as "M" message into its mailslot and performs task switch if expedient. If it is not certain on the part of SIDEXIS whether the patient is already known to teleradiographic analysis, an "N" message is sent to it previously
Teleradiographic analysis	After activation examines its own mailslot, activates the desired patient and loads the transferred image. Previously all "N" messages are processed as a precaution. The loaded image or its reference is integrated if necessary in the own database of the teleradiographic analysis

5.4 Token "N": NewPatient / New registration of a patient

Creates a new patient. New registrations of already existing patients are ignored or in the case of a valid external card index number examined for data changes and updated accordingly (corresponds to token "U" except for changing the external card index number).

The present interface is intended for international use. Characters from the national language are therefore also used. In the German language area, the umlauts written out in the data delivered by PM (e.g. 'ae' instead of 'ä') should be combined to form the corresponding umlauts in order, for instance, to compensate for the special features of certain readers for German hospital cards.

Expected data fields / Identification:

-

Expected data fields / Information:

1. Name of patient
2. First name of patient
3. Date of birth
4. External card index number
5. Sex
6. Permanent dentist
7. Address of sender
8. Address of receiver

Example:

Process	Action
User	Creates new patient in PM
PM	Here no "N" message is necessary initially for SIDEXIS, since creation of patient data within SIDEXIS is expedient only in connection with the production of images. => No action
User	Requests an image for this patient within PM
PM	Writes "N" message into SIDEXIS mailslot
PM	Writes "X" message (image order) into SIDEXIS mailslot
SIDEXIS	Processes "N" message
SIDEXIS	Processes "X" message

5.5 Token "S": SelectPatient / Preselection of patient

With this token, in each case the first "S" message in the mailslot is used to select the corresponding patient preferably in the patient selection list in the dialog of the receiver. It is the responsibility of the sender to ensure that the patient to be selected was already newly added at the receiver, i.e. before "S" for a patient, an "N" should be sent for this patient at least once. In case of identification through the external card index number, the remaining patient-related data can be updated automatically as required.

This token is still included in the scope of functions for reasons of compatibility with old installations, but it should no longer be used in the future, because the required functionality is covered better by the tokens "A" and "X".

Expected data fields / Identification:

1. Name of patient
2. First name of patient
3. Date of birth
4. External card index number

Expected data fields / Information:

1. Station name of the calling station
2. Date of call
3. Time of call
4. Address of sender
5. Address of receiver

Expires: Such a token message is to be deleted automatically from the receiver's mailslot by the receiver if older than 24 hours.

Example:

Process	Action
User	Requests patient X in PM for later work with SIDEXIS
PM	Writes "S" message into SIDEXIS mailslot
User	Starts the dialog in SIDEXIS for patient selection at any later time
SIDEXIS	Reads "S" message and preselects patient X
User	Patient X is already preselected and can in this way be selected more easily

5.6 Token "T": Take / Producing an image

Message concerning an image produced. As a rule, the diagnosis is still empty at this time.

PM must also be prepared to record images which were produced without an order or in which PM is not the client (order number = 0). The patient-related data, image types, reasons/diagnoses as well as image date and time serve for putting these images in order.

Expected data fields / Identification:

1. Order number
2. Name of patient
3. First name of patient
4. Date of birth
5. External card index number
6. Image number

Expected data fields / Information:

1. Sex
2. Pregnancy statement
3. Image type
4. Date of image
5. Time of image
6. Person in charge
7. Reason/Notes
8. Diagnosis
9. Radiation duration
10. Tube voltage
11. Tube current
12. Address of sender
13. Address of receiver

Example:

Process	Action
User	Produces an image with SIDEXIS
SIDEXIS	Writes "T" message in PM mailslot
PM	Reads "T" message, if necessary initiates accounting for the service

5.7 Token "U": UpdatePatient / Changing patient data

Every change of the patient data of patients with existing images must be reported to SIDEXIS.

Note that - as a safety feature - an app should not accept "U" tokens where patient name (or first name) and date of birth are changed simultaneously!

Expected data fields / Identification:

1. Name of patient (old)
2. First name of patient (old)
3. Date of birth (old)
4. External card index number (old)

Expected data fields / Information:

1. Name of patient (possibly new)
2. First name of patient (possibly new)
3. Date of birth (possibly new)
4. External card index number (possibly new)
5. Sex (possibly new)
6. Permanent dentist (possibly new)
7. Address of sender
8. Address of receiver

Example:

Process	Action
User	Changes the name of patient X in PM for whom images are stored in SIDEXIS
PM	Writes "U" message in SIDEXIS mailslot
SIDEXIS	Reads "U" message, updates data of patient X in its own database

5.8 Token "X": X-ray Image / Image order

Order for producing an image. The patient to be X-rayed is preferably selected if this has not yet happened, i.e. an "S" message would not be required in this case.

Orders for patients unknown to the order receiver are ignored. In case of identification through the external card index number, the remaining patient-related data can be updated automatically.

To obtain unambiguous order numbers easily, combinations from patient number and date/time can be used. If several orders, which for instance in each case specify a single tooth, belong to an overall order, then the assignment of the single orders to this overall order can be achieved by having their order numbers originate from a certain numerical range, e.g. total "status" order with single orders 1,001 to 1,020.

Expected data fields / Identification:

1. Order number
2. Name of patient
3. First name of patient
4. Date of birth
5. External card index number

Expected data fields / Information:

1. Sex
2. Statement on pregnancy
3. Image type
4. Image reason/Notes
5. Station name of the calling station
6. Date of the order
7. Time of the order
8. Address of sender
9. Address of receiver

Expires: Such a token message is to be deleted automatically from the receiver's mailslot by the receiver if older than 24 hours.

Example:

Process	Action
User	Assembles image order
PM	Writes "X" message into SIDEXIS mailslot
User	Starts the dialog in SIDEXIS for patient selection or accepts order directly at an arbitrary later time
SIDEXIS	Reads "X" message, facilitates the fast selection of the desired patient by pre-selection
User	Produces the image
SIDEXIS	Writes "T" message into PM mailslot

6 Data lexicon

The table below lists the relevant details for patient and image-related data fields.

The data for the lengths of the data fields are specified permanently or stated as maximum lengths in bytes, without terminating 0 byte, that can be processed by SIDEXIS.

All strings must be present in DOS-extended ASCII character set!

Abbreviation	Description
"nec."	required for the corresponding orders;
"suppl."	can be supplied for the corresponding orders, values in brackets can be delivered by SIDEXIS only if the user (or PM on placing the order) has stated them.

Data field	Length	Comments	nec.	suppl.
Patient-related data				
Name	max. 32	Code part 1 if ext. card index no. is empty '@' character, leading/trailing space characters not allowed	✗	✗
First name	max. 32	Code part 2 if ext. card index no. is empty '@' character, leading/trailing space characters not allowed	✗	✗
Date of birth	Date s.b.	Code part 3 if ext. card index no. is empty	✗ [*)]	✗
Sex	fix 1	"M" = Male "F" = Female Other = Unknown	✗	(✗)
Pregnancy	fix 1	"P" = Pregnant "N" = Not pregnant Other = Unknown Only verified if sex = "F"	✗	(✗)
Ext. card index number	max. 20	Regarded as code, if not empty; any string, but reduced character set (see below)	✗	✗
Permanent dentist	max. 128 [**)]	(Initials of) the dentist who usually treats the patient. For purposes of identification, combinations with the initials of the assistant are possible (relevant for the "Person in charge" (see below)		(✗)
Image-related data				
Order number	max. 10	Double word as string (values 1 through $2^{32}-1$); unambiguous number for the order to which the image pertains 0 if image was produced without order	✗	✗
Image number	max. 10	Double word as string (values 1 through $2^{32}-1$); number of the (new) image for this patient	✗	✗
Image type	fix 4	Classification of image type - formatting see below	✗	✗
Person in charge	max. 128 [**)]	(Initials of) dentist responsible for production of this image (usually permanent dentist)		(✗)
Date of image	Date s.b.	See general date format		✗
Time of image	Time s.b.	See general time format		✗
Reason for image(s)	max. 31	Reason/notes for this images/these images (Future apps may accept a longer reason; if an app encounters a reason longer than it can accept it may cut the text after its own maximum length has been reached)		(✗)
Diagnosis	max. 4999	Any string, possibly with ASCII control characters for line feed/carriage return (0x0D + 0x0A)		(✗)
Radiation duration	max. 5	Word as string (values 1 through $2^{16}-1$); stated in milliseconds		✗
Tube voltage	max. 5	Word as string (values 1 through $2^{16}-1$); stated in kV		✗

Data field	Length	Comments	nec.	suppl.
Tube current	max. 5	Word as string (values 1 through 2^{16} -1); stated in mA		×
Practice-relevant data				
Station name	max. 20	String; letters, numbers as well as the following characters !#$%()-.@^_'~ are allowed (blanks not allowed!), serves for user information, also on queries – Note: Must be user name instead of computer name in a thin client Terminal Server environment!		×
Order date	Date s.b.	For messages that are only temporarily valid; serves for recognizing timeouts		×
Order time	Time s.b.	For messages that are only temporarily valid, serves for recognizing timeouts		×

[*] Advanced apps like SIDEXIS 4 may be able to tolerate a missing date of birth. In this case provision of an unambiguous ext. card-index no. by the sending app is obligatory to identify a patient.

[**] Legacy apps like SIDEXIS XG should be able to process token messages with permanent dentists or persons in charge exceeding the internal length maximum. The field values should be used up to the last character fitting into the internal field. F.ex., internal max. length = 12, dentist sent = "1234567890123" => "123456789012" used internally.

6.1 Date format

A date is stated as a character string in the form of "DD.MM.YYYY" ('D' = day, 'M' = month, 'Y' = year). International compatibility is not required here because this format does not come through to the user interface.

6.2 Time format

A time is stated as a character string in the form "HH:MM:SS" ('H' = hour, 'M' = minute, 'S' = second) in the 24-hour format. International compatibility is not required here because this format does not come through to the user interface.

6.3 Image type

Statement of the image type reduces the necessary communication and data volume entered and thus accelerates order placing and acceptance. The type which – if not defined explicitly (*) - never must be empty is described as below, according to the scheme "AABC" ("AA" defines anatomic region or device program no., "B" defines the main category and "C" defines a subtype thereof):

Pos.	Image type	Contents
"AA"	Intraoral (X-ray/still video), CEREC image or slice X-ray	2-digit number = International tooth no. (FDI tooth scheme) of the imaged tooth or of one of the imaged teeth
	Panoramic images	2-digit number = Pan program no. (Sirona-specific Pan program definitions)
	Teleradiographic ("Ceph.") X-rays	"01" = Front view from behind (PA) "02" = Front view from the front (AP) "03" = Lateral view "04" = Teleradiographic hand image
	3D/DVT/Cone Beam CT/Dental CT	Diverse combinations of 2 letters or digits (Sirona-specific 3D program definitions)
	Not diagnosable	"~~" (twice ASCII code 126)
	Other / Unknown	2 blanks (" ") for other (not further specified) images
'B'	X-ray	'X'
	2D still video or CEREC image	'V'
	Unknown	'?'

Pos.	Image type	Contents
'C'	Intraoral images	'I'
	Panoramic images	'P'
	Teleradiographic ("Ceph.") X-rays	'C'
	Transversal (or any) slice X-rays	'S'
	3D/DVT/Cone Beam CT/Dental CT	'V'
	Frontal still video image/3D face scan projection	'F'
	CEREC image	'C'
	Unknown subtype	'?'

Examples of image types:

"41XI"   =   Intraoral X-ray image of tooth 41

"53XI"   =   Intraoral X-ray image of tooth 53 (denture/milk teeth)

"01XP"=   Panoramic tomogram with Orthophos Program 1

"03XC"=   Teleradiographic (Cephalometric) image, lateral view

"41XS"=   Transversal X-ray slice image of tooth 41

" XV"   =   Cone beam volume (or 2D projection thereof)

"41VI"   =   Intraoral still video image of tooth 41

"41Vc"   =   CEREC still video image of tooth 41

If an image of a single tooth is desired, as for example for measuring the root canal, then the tooth number should also be stated in the order. This number can then be reported back directly after the image is produced without further interaction with the user, since the image type can be obtained directly from the order. Supernumerary teeth should be referenced by the next "normal" tooth, e.g. "28XI" for tooth 29, with a corresponding entry in the Reason/Notes column.

6.4 Address format

An address has the format "\\<Station name[*)]>\<App name>". For the receiver, one of the two items may be a wildcard ("*") but not both. No wildcards are allowed for the sender.

[*)] = User name in a thin client Terminal Server environment

6.5 External card index number

The external card index number may contain any combination of letters and numbers, plus one or several special characters from the following set (character '}' (ASCII code 125) is used exclusively for patients manually entered directly in SIDEXIS):

Character		!	#	$	%	&	'	(	)	*	+	−	.
ASCII code	32	33	35	36	37	38	39	40	41	42	43	45	46
Character	/	:	;	<	=	>	?	@	\	_	`	|	
ASCII code	47	58	59	60	61	62	63	64	92	95	96	124	

Leading space characters (ASCII code 32) ARE allowed. Trailing spaces are NOT allowed. Nevertheless, should they occur, then they must be ignored during identification. Leading blanks are to be stored, trailing blanks are to be cut off.

Note that, in order to be unique, 2 card index no.s containing letters must still differ if they are compared in a case-insensitive way, i.e. f.ex. no.s "x123" and "X123" are NOT considered to be different!

7 Configuration

7.1 Settings within the apps

Initialization routines store the path and name of the own and of the external mailslot in the integrated apps. This serves at the same time as an indicator of the existence of such a connection. It should be noted that the path under which the sender has reached a mailslot in the network does not absolutely have to be identical with the path under which the receiver addresses this mailslot (different allocation of drive and path names in the network, "Mapping").

F.ex. manual configuration of SIDEXIS is described in its service manual.

7.2 Distribution of the apps to stations

In implementation, one should always have in mind that the communication partners can be installed both jointly on a single station and also on several distributed stations which are connected through a network.

In the evaluation of the message, it can occasionally also be of importance whether a message originates from another station or from one's own station. A fully automatic patient switchover is frequently expedient only if the associated message comes from the same station and a local task switch has taken place (e.g. from PM to SIDEXIS).

7.3 Mailslot usage

In principle there is a large variety of configuration possibilities in the use of the mailslots. However, it is usually possible to proceed according to the rule "One mailslot per database". Here those apps which also use a common database always share one mailslot. These are as a rule the different installations of a certain app in a multi-user environment. This procedure corresponds to the approach in version 1.2 of this document with exactly two app classes (PM + SIDEXIS).
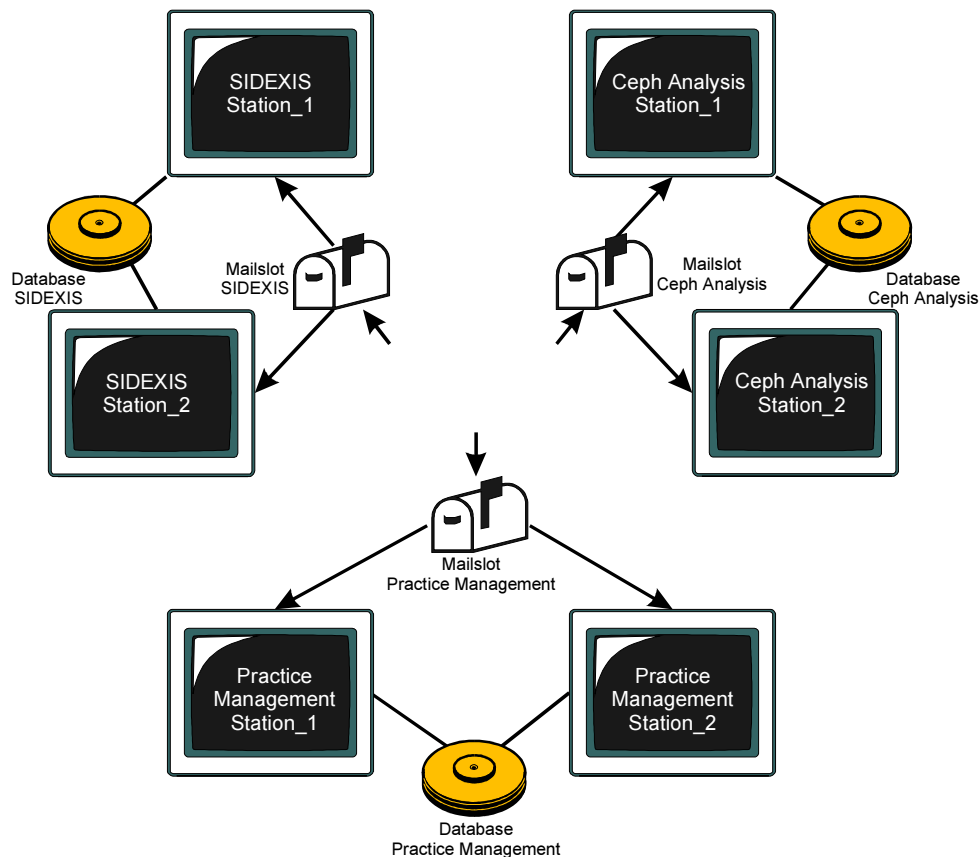
3 application groups (multi-user installations), each with its own database

It is usually then unimportant which station of such a group receives a certain message. For instance, with several SIDEXIS viewing stations, which of these stations was used for diagnosis is immaterial. Also in a multi-user installation of a PM system, it does not matter which of the stations for example enters new patient-related data in the common database. In such cases, the equivalent stations share one mailslot. The first free station processes a message as customary, and adds the data into its own database which is used jointly by several stations. Since it then immediately deletes the message from the mailslot, unnecessary multiple processing is prevented.

If several databases are installed within an application class, then each of the subgroups thus created must be assigned its own mailslot. This situation can occur, for example, in strictly separate patient master files in group practices.

If every partner does not have to communicate with every other, then certain paths can be left out from the communication. This reduces the complexity in configuration.

Communication between different installations of the same app can also be desirable. Thus, for example, X-ray orders can be sent to other SIDEXIS stations directly in SIDEXIS. In this case, access to the own mailslot is both reading/deleting and writing.

7.4 Configuration items

The apps participating in the communication should store the following data for each of their possible communication partners:

1. The name, which should be made accessible to the user;

2. Position and name of the mailslot;

3. Automatic task switch possible: Yes / no, app name + path, window class name (if the task switch cannot be reached by automatic restart);

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4. Is the app a PM system: Yes / No. If several apps have to be operated for accounting, then each receives its own entry in which this attribute must be set. SIDEXIS then sends messages which cannot be clearly assigned to a certain sender (such as the manual addition of new patients directly in SIDEXIS) to all apps with this attribute. The receiver must then decide whether the particular message is relevant for him or not.

Example:

Name	Mailslot	Task switch	PM
SIDEXIS	z:\slots\sidexis.sdx	Yes, c:\sidexis\sidexis.exe	No
PM	z:\slots\pm.sdx	Yes, c:\pm\pm.exe	Yes
Analyst	z:\slots\analyst.sdx	No	No

8 Special cases

This chapter deals with the expected behaviour of the receiver if certain error conditions occur.

8.1 Syntactic errors

If syntactic errors occur inside a token message, this message has to be discarded by the receiving app.

If syntactic errors occur in a way that the whole or the subsequent rest of the mailslot file is compromised, the whole or the subsequent rest of the mailslot contents has to be discarded by the receiving app.

8.2 Semantic errors

8.2.1 Multiple "A" token messages for a patient at a station

If all those messages contain the same data then all but the last message can be discarded and the last must to be processed.

If those messages contain different data like different image numbers then all of them must be processed at once. This can be normal and required behaviour in the case when the sending app tries to open more than 1 image in the receiving app simultaneously.

8.2.2 Multiple "A" token messages for different patients at a station

If multiple "A" token messages occur for the same station then the latest should be processed and all older ones discarded.

8.2.3 Multiple "X" token messages with the same order no.

If "X" token messages with the same order no. occur in a mailslot file more than once then the oldest message should be processed and the others discarded.

8.2.4 Discarding "M" token messages

If an "M" token message is to be discarded the image/DICOM file(s) belonging to it are to be discarded as well.

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9 Questions & Answers (Q&A)

9.1 Can implementation be step by step?

Yes. Implementation of the SIDEXIS <=> PM communication, for instance, can take place in several steps:

1. Transfer of patient data into SIDEXIS from PM (token "N")

2. Automatic registration of patients in SIDEXIS from PM (token "A")

3. Message to PM concerning images produced with SIDEXIS (token "T")

4. Extended X-ray order from PM to SIDEXIS with order overview there (token "X")

5. Adjustment of the patient data in both directions (tokens "N" and "U")

6. Adjustment of subsequently changed supplementary data of the images in both directions (token "I")

7. Automatic display of images in SIDEXIS from PM (token "A")

9.2 How do you know whether a patient already exists in SIDEXIS?

Before "A" and "X" messages, an "N" message must have been sent at least once for the corresponding patient. So that it is not necessary to note the patients for whom images have already been produced or which patients are already known to the receiver, message "N" can simply be sent once again before every order. If the patient already exists and his data have not changed, SIDEXIS will simply ignore and delete this message.

9.3 Why isn't SIDEXIS reacting?

Can the SIDEXIS installation access the mailslot? Check the network.

Do the communication partners refer to the correct mailslot?

9.4 Why doesn't SIDEXIS react to certain tokens?

Under certain circumstances, the communication does not function even if access can be made to the mailslot. Syntactically incorrect messages are deleted by SIDEXIS without comment.

Typical errors:

- The length statement of a message does not comprise the entire message including the carriage return or it ignores the string end marks that are also output

- Output of the string end marks is forgotten

- Not all expected strings were output (empty strings must also be output: 1 string end mark)

9.5 Why doesn't token 'A' function?

Was the message completed with the desired station name?

Is this station name identical with that stated in the activated SIDEXIS installation?

9.6 Why don't the examples function?

The examples stated in this document are not intended for testing. Order messages "A", "S", and "X", respectively, are deleted if they are older than 24 hours. Therefore it is possible to test only with orders of the current date.

9.7 How are mailslot access conflicts avoided?

The access times to the mailslots must be minimized. This can be done, for example, by minimizing the time during which a mailslot is kept open, since it is blocked for other apps during this time. For this purpose the mailslot is opened briefly and the contents are copied. After the mailslot is closed, the messages concerning the processor are processed locally. The mailslot is then opened. The processed messages are deleted there if they are still present. The updated mailslot contents are written back and the mailslot is closed.

9.8 Can an X-ray control book be kept automatically?

Yes. The X-ray control book which has to be kept in Germany can be kept by SIDEXIS or by PM. SIDEXIS supplies all information necessary for the produced X-ray images, such as pregnancy statement, region of the body imaged (via the image type), diagnosis as well as data for calculating the dose.

9.9 What must be done on failure of the PM system?

SIDEXIS is also designed to function standalone if, for instance, connections in the network as well as to PM are not available in case of hardware failures. Emergency acceptance of previously unknown patients directly in SIDEXIS is possible. However, it will then be necessary to transfer the new data on return to normal operation. Here it is also necessary that PM integrates the new patients in its own database and reports corrections and newly allocated external card index numbers via "U" messages to SIDEXIS – with the external card index number allocated by the user in emergency operation as identification or with blank external card index number on identification via name / first name / date of birth. Since the external card index numbers allocated on entry in SIDEXIS have no meaning for PM and can be ambiguous, PM must identify such patients by name / first name / date of birth until the transmission and processing of the corresponding "U" message by SIDEXIS.

9.10 What must be done on changing the PM system?

Even after a change, the patients known to the apps that are otherwise still present must remain capable of activation.

If the PM app is changed and provided patients are identified by external card index number in both PMs, all patients known to SIDEXIS must be converted to the new number by "U" messages when there is a change of the external card index number. The patients are identified by the new number, starting from this one-time conversion. Identification by the external card index number is preferable, since it also functions in special cases, such as in case of a change of patient data after producing an X-ray image with subsequent PM change. SIDEXIS would then not be informed about this change, and in this case can find the patient only through the old number in the "U" message, whereas the patient in this case can no longer be found again by SIDEXIS in case of identification by his data.

9.11 Who is my contact in case of questions?

In case of questions on usage or implementation, please contact

- for general purposes:

www.sirona.com/en/contact/requests

www.sirona.com/de/kontakt/anfragen/

- for programmer´s questions:

mailto:Develop.Sidexis@sirona.de

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