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THE CUSTOMER SUPPORT SERVICE DEVELOPMENT FOR USER APPLICATIONS

Abstract: *The article includes information about development of chat bot support service, additional service for working with tickets and detailed description of how we work with files. Also there is information about testing and its types.*

Key words: *Telegram, chat-bot, helpdesk, GLPI*

Language: *English*

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Introduction

In our first paper [1], we talked about such a developed product as a user support bot. In that paper, such points as the planning of the components of which the product being developed will be made and the creation of the component scheme, which reflects the main services of the product, were revealed. In addition, a sequence diagram was developed for simplifying the understanding of the entire process of the product being developed for people far from the development process itself. And also, the main task of the previous article was to know what support systems are, what their purpose is, and summarize the main ways of interacting with such systems. If the goal of the past research was to familiarize with the analytical processes and the planning process, then the goal of this work is directly the development of the support bot itself.

Dialog concept

Recall what a bot is. A bot is a program that tries to create the impression that it is not a program, but a living person; a program that automatically or on schedule, without any actions of a person, performs various actions: responds to a message, makes various informational mailings, etc. [2]

The main function of a bot is to communicate with people, so before developing a bot, you need to think through the program's dialogue with the user, that is, determine the most basic actions, the behavior of the bot.

Since we are developing a support bot, all its actions should be aimed at enabling the user to create an application without any problems and get an answer on it. We formulate these basic actions:

- ticket creation;
- ticket appending;
- cancelation of the ticket by the user;
- ticket sending;
- getting the ticket solution.

For each action from the list, you must formulate a message that will come to the user in the chat. In addition, since the development is initially carried out for the Telegram platform, we will use the convenient tools that it provides, such as inline keyboard - these are the buttons that come with the message, and in addition, these buttons are easily removed when they are no longer are needed. Such buttons will be useful to us also because with their help the user will be able to choose what he wants to do. For example, there will be a «*Create request*» button or a «*Cancel request*» button, and at the choice of one of such a button, we will be able to explicitly recognize what the user wants to do, execute his command and provide some answer.

Also, besides the fact that we formulate the texts, it is necessary to think over the entire sequence of dialogue and transitions on the formulated messages that the user can make. After much deliberation and discussion, we came up with this result (see Fig. 1) - we offer the user to create a ticket, then he must enter his first message or cancel the application. After that, he can either append it or send it. It is meaningless to suggest canceling it, since he has not even created it yet (entering a message does not mean creating a ticket in the support system), so if he does not want to send an application, he can simply stop and not take any action.

After the ticket has been submitted, the user can still supplement it - all of a sudden he has some thoughts. If he does not want to send, then he just has to wait for an answer. At the same time, he may cancel it if, for example, he has already resolved his own question. And it is also possible to create a new ticket.

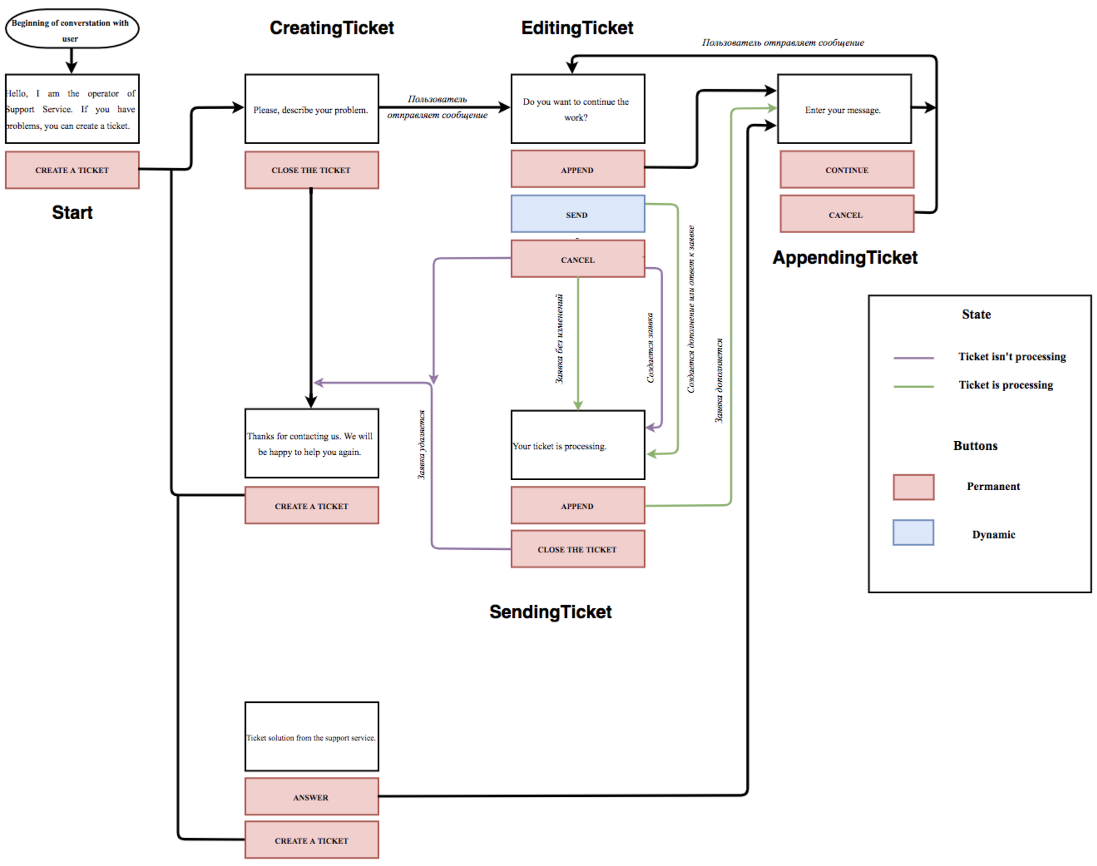
Beginning of converstation with user
Hello, I am the operator of Support Service. If you have problems, you can create a ticket.
CREATE A TICKET
Start
CreatingTicket
Please, describe your problem.
CLOSE THE TICKET
Пользователь отправляет сообщение
EditingTicket
Do you want to continue the work?
APPEND
SEND
CANCEL
Пользователь отправляет сообщение
Enter your message.
CONTINUE
CANCEL
AppendingTicket
Заявка без изменений
Создается заявка
Создается дополнение или ответ к заявке
Заявка дополняется
Заявка удаляется
Thanks for contacting us. We will be happy to help you again.
CREATE A TICKET
Your ticket is processing.
APPEND
CLOSE THE TICKET
SendingTicket
State
Ticket isn't processing
Ticket is processing
Buttons
Permanent
Dynamic
Ticket solution from the support service.
ANSWER
CREATE A TICKET

Figure 1. The first dialogue implementation

We will discuss the nuances that arose after the first implementation of such an interaction below.

The first implementation of the dialogue

Now that the dialogue and all transitions are formulated, we can proceed to its implementation. First, select the main buttons that are used in the dialogue:

- «Create a ticket»;
- «Cancel the ticket»;
- «Cancel» (but already cancel the addition, it is important to distinguish between these two buttons);
- «Append»;
- «Send».

As you can see from the flowchart (see Fig. 1), when you press each of the buttons, we move to another well-defined state - thus, it is important for us to know where the user is now and store this state in the database. There are five such states (see the captions to Fig. 1):

- the state of start or beginning is the point at which the user is when he sees the message about the offering for creating an ticket (selection of the */start* command);
- the state of creating a ticket;
- editing the ticket state;
- appending state;
- sending state.

Such an approach, with the determination of a finite number of states, is called a finite automaton. A finite automaton is an abstract model containing a finite number of states of something [3]. Used to present and control the flow of execution of any commands. The state machine is ideal for implementing artificial intelligence in games, while we get a neat solution without writing cumbersome and complex code.

The first implementation of the dialogue was just this: we defined a finite number of states, defined transitions. For each button of the keyboard there is a so-called callback data, you can store absolutely any information in it. This is the data that is not displayed to the user but is a certain metadata of a specific button - for our situation we stored some value that uniquely identifies this button.

When any action came from the user, we first determined what state the user was in (this value was currently received from the database) and then we looked at the type of action that came — whether it was a message or an event when a button was pressed, in the latter case we also looked and the callback data of this button. And already on the basis of this knowledge they decided what to display to the user - which text and which keyboard.

The second implementation of the dialogue

The approach described above was good until a certain point, until it was necessary to develop the functionality of simultaneous work with several tickets. In the described approach, it was simply impossible.

For example, if a user worked with ticket #1, stopped at entering a message and entered the */start* command, then he simply could not return to work with ticket #1, since being in the Start state, he could not enter messages - could not press the «Add» button, because in the Start state there is simply no description of how to work with this button (after all, as can be seen from Figure 1, you can work with the «Add» button only from the Editing state).

Therefore, we have to move away from states and a well-defined transition logic. Changes to the previous flowchart can be seen in Fig. 2. What has changed in it and in implementation? First, we would like to note that since we used to work at one time only with one ticket, the database for each particular user had one ticket number, now it was necessary to store the history, and, besides, somehow recognize which ticket we are working with now.

As noted earlier, each button has callback data, and we can configure it as you like, so it was decided to leave some unique designation of this button (create, close, send, append, cancel) and in addition to add the ticket number with which we work . It looks like this now - for example, send_145 means that we have the «Send» button and, when pressed, we will send the ticket with number 145 to the support system. And now, when an event about pressing a button comes from the user, we can safely determine which button is pressed and which handler now needs to be called, and with which ticket we are working.

Also, the value of callback data we write to the database for each user at each time point, when the user performs any actions with the bot, because we need to know, for example, at what point in the dialogue the user enters a message: at the first moment of creating the ticket (the first message - the user pressed the button with callback data = create) or it is the addition of the ticket (append), because the handlers for these events will also be different.

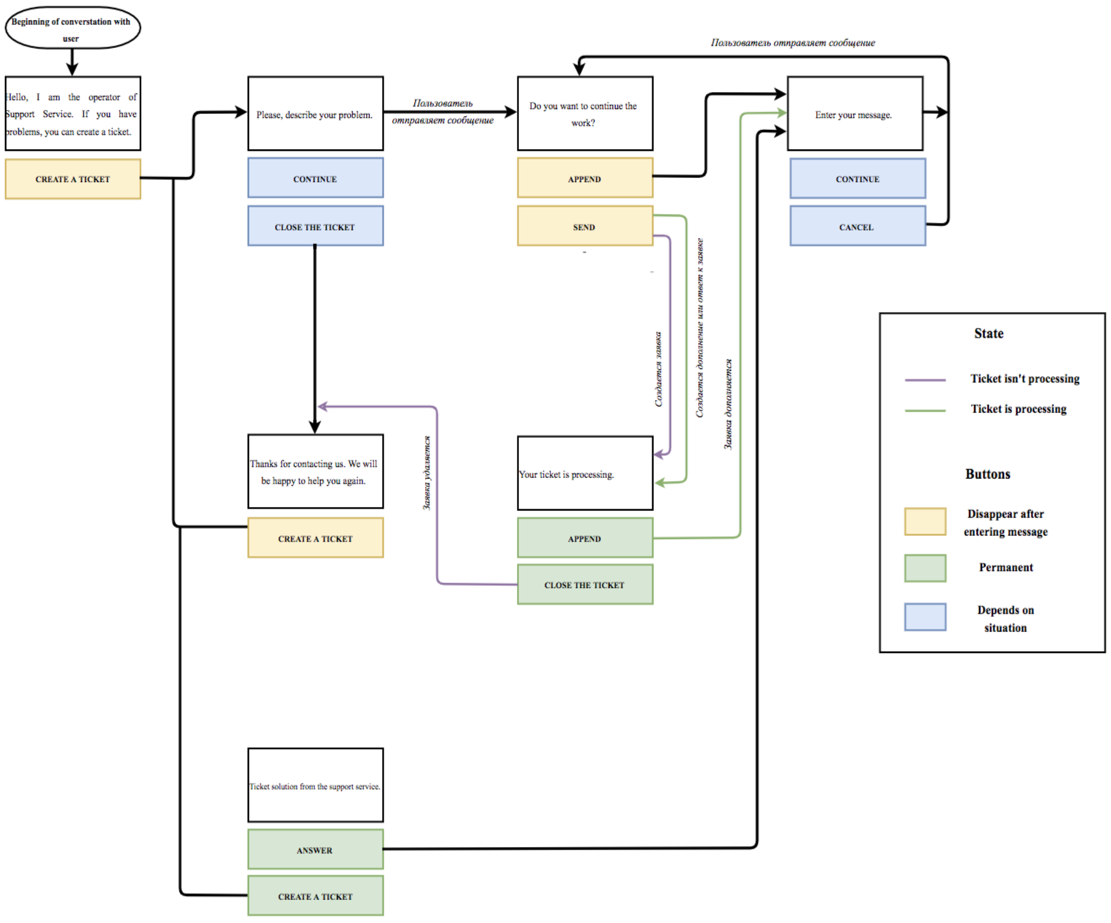
Beginning of converstation with user
Hello, I am the operator of Support Service. If you have problems, you can create a ticket.
CREATE A TICKET
Please, describe your problem.
CONTINUE
CLOSE THE TICKET
Пользователь отправляет сообщение
Do you want to continue the work?
APPEND
SEND
Пользователь отправляет сообщение
Enter your message.
CONTINUE
CANCEL
Создается заявка
Создается дополнение или ответ к заявке
Заявка дополняется
Заявка удаляется
Thanks for contacting us. We will be happy to help you again.
CREATE A TICKET
Your ticket is processing.
APPEND
CLOSE THE TICKET
State
Ticket isn't processing
Ticket is processing
Buttons
Disappear after entering message
Permanent
Depends on situation
Ticket solution from the support service.
ANSWER
CREATE A TICKET

Figure 2. The second dialogue implementation

In addition, a new button «Continue» appeared. Note that the chat history is saved in the chat itself (until the user clears it), which gives us the opportunity to return to work with the ticket that has been created for a long time. As can be seen in the flowchart (both new and previous), the green buttons are permanent and are not deleted during the dialogue, that is, at any time, until the ticket is resolved, you can safely scroll through the message history and add (or cancel) the ticket.

As for the blue buttons, it depends on the situation. If the user enters a message and at this moment decided, for example, to create a new ticket, then we will have the «Continue» button, which makes it possible to return to entering the message later. That is, any action that interrupts the input of a message causes the «Continue» button to appear, and the cancel buttons remain. And if the user has entered a message, then the blue «Cancel the ticket» and «Cancel» buttons simply disappear, as before on diagram 1.

As a result, we received a more universal processing of the dialogue steps and refactored the program code in such a way that when adding a new button, it would be enough for us to write a new handler and add it to the factory (the factory will be discussed in the section on implementation), which will return the handler, depending from what callback data came, or in what state the message came. Indeed, earlier, when introducing a new button, a sufficiently large amount of code would have to be changed, depending on how many states this button is used.

And, abandoning well-defined states, we implemented a mechanism for simultaneous work with several tickets, which allows the user to supplement old tickets (if they, of course, have not yet been resolved) and create new ones, while not losing the opportunity to work with other tickets.

Support Service implementation

We now return to the implementation of one of the developed services - Support Service and Account Service. At the same time, we will not consider the Account Service as a separate service, with us it's just a data access layer — that is, a computer program layer that provides simplified access to data, namely, various information about user accounts, bot accounts, etc., stored in any type of permanent storage, for example, a relational database.

At the same time, the Support Service is an implementation not for one particular bot, it is an implementation in which you can register many bot accounts that will perform the same actions. We need such a mechanism, because in the company where one of the authors works, there are many different projects, and all of them need their own support.

The question arises, why not use one bot support for all projects. There is a simple answer to it - the support system in this case will simply not understand from which project exactly the ticket came. It would be possible, of course, before each creation of the ticket to ask, «where did you come from?», but this would be very inconvenient. Moreover, it is very difficult to filter such information within the support system and it would be difficult to make the mechanism for separating tickets from different projects universal.

And by creating different bots and connecting them to the same Support Service (and registering the bot with the Ticket Service), we can easily, when registering a bot account with us, assign to it a uniquely identifier - meta information that we can already send to the Ticket Service and create tickets in the support system for projects defined for this bot - this will be described in more detail in the section on the implementation of the Ticket Service.

We describe how the development begins. First, we will develop a Web API application using ASP.NET Core. Web API is a way to build an application that is specifically tailored to work in the style of REST (Representation State Transfer, or "transfer of presentation state"). The REST architecture implies the use of the following methods or types of HTTP requests to interact with the server:

- GET;
- POST;
- PUT;
- DELETE.

To process requests in our application, a special controller is used for which the route is defined. The first controller to be written is the controller that processes messages from Telegram. This is an option for the first implementation, later a controller will appear, processing messages from Facebook (FB) and any other instant messengers - each external service has its own controller.

As a result, the appeal to the address *api/telegram* will correspond to the appeal to the «TelegramCotroller» controller. Inside the controller there are methods to which the special attributes [HttpGet] or [HttpPost] are applied, which indicate which type of request will be processed by the method.

In our controller there will be only one single method - the Post method, which is able to receive messages from Telegram. At the same time, we can write absolutely any path to each method, for example, the path to the method that receives the update from Telegram is as follows: *api/telegram/{botToken}*, where botToken is the token of a particular bot account, we need it to we could recognize which bot comes from.

An important question arises, how to force Telegram to send messages exactly on such a path - this is done by registering a webhook. Every time when we register a new bot account with us in the service, we have to ask him a webhook, and then all updates (all user messages) will be sent to this address.

We will need another controller to process requests from the Ticket Service when it sends us messages about the decision of the application. We also need to provide an outside API for registering bot accounts - this is necessary because usually simple developers may not have access to databases in the production area, and they will not be able to add an entry manually. And it is important for us to store this information, because otherwise, anyone can register a webhook on any bot and use our service, and we are unlikely to be able to find out.

Above, we described the most basic part of the Web API application - controllers, with the help of them we get information from external services that send us requests. Since the development itself can be written a lot, long and deployed, which greatly exceeds the reasonable size of the article, we would like to highlight the main points that were developed for the Support Service.

First, an important part of the application is the data warehouse. For Support Service, the database scheme was designed so that we could store information about users, and from which channels and bots they came, information about channels and channel accounts (the channel in this case is the instant messenger, and the channel account is a specific bot and the history of applications - by which user, by which bot they were created.

It is also important to abandon any specific data contracts in the service itself (Telegram data contract or Facebook data contract), so you will have to constantly expand your application, write separately the data processing for Telegram, separately for FB, separately for another messenger. It is necessary through the controller to take a specific contract from the messenger and be able to convert it into our data type, which we will use in all places of our application - it is easier to write one hundred converters than to write one hundred handlers of the same meaning. And thus, we will be able to write just one kind of internal service with the HandleUserAction method, which will accept the already converted data type as an input and implement this method in all controllers.

As for working with objects Telegram. We have previously determined that we work with an inline keyboard, plain text messages (and various image's and documents are added, but within the framework of Telegram they are still considered as a Message type, which has corresponding attributes for each of the Text, Photo, Document types etc.) and commands that begin with the «/» symbol.

When Update comes from the user, we have to convert it into one of the types that are common for the whole service (we identified two such types for ourselves: CallbackItem - the «button» type and MessageItem - the «message» type - we notice right away that these will be two universal type, because all bots have buttons, all have messages, it is important for us to share it). And in order to make processing even more universal, we will highlight the IUserAction interface, which both of these types will inherit.

After that, we need to process any of these types, and process not only depending on what came - the button or the message, but also depending on which button came (from which callback data), or at what moment a message has been received (at the time of creating the application or at the time of its appending).

For the first situation, everything is very easy, we take IUserAction to the internal method and just see what it is - if it is a message, then we process it as a message, if it is a button, then we process it as a button. But in order to decide that if it is a button, then what exactly needs to be done in response to its arrival, the design pattern «factory» will help us - this is the generating design pattern that solves the problem of creating various products without specifying specific classes of products.

Consider this on the example of buttons. We have five buttons, each has its own specific callback data, according to which we will decide which handler to call. All handlers with us should be essentially monotonous. Thus, we can select an abstract class that will have a Handle method. Each button class will inherit this abstract class and implement its own version of the Handle method.

As for the factory method itself, it accepts IUserAction as input and it will already decide whether we can work this action as a button and return the corresponding class object - if we can, then we return this object (created through new) and in the external method call the Handle method. This is a very universal approach because:

1. We pass the IUserAction type to the factory method (as we know, its implementations are either MessageItem or CallbackItem).

2. Then we decide: can we process this input value as a button or as a command or as a message.

3. If we can, then simply return the object of the class and then call the Handle method of this object. And it is not at all necessary for us to know what kind of object it has returned and what class it is from - it has the Handle method, end of story; we define the processing logic inside the factory method.

Another important point. If we work universally at the input point of the application (when messages from messengers arrive), then it is also important to work universally at the output point — when our service is already sending out answers. This is done in the same way, only at the output we convert our internal type into a specific data type of a specific messenger and send it. We have a single output point, where we decide where, in fact, we have to send an answer, and we send it there. This is done according to the principle of the same factory method: we have a single interface and its various implementations, and depending on the destination messenger, we select the implementation and call the Send method, and our message goes where appropriate.

Ticket Service implementation

Now we can go to the description of the development of the service ticket. The main tasks of the service ticket:

- receiving messages created by users;
- processing and saving in our database;
- work with the support system API (creating an application, adding a comment, closing an application);
- receiving and processing a response from the support system, sending the result to the support service.

Ticket service is a separate service that has its own API. Highlight his methods:

- creation of the ticket;
- appending of an existing ticket;
- sending the ticket;
- closing the ticket by the user;
- check the status of the ticket - it is closed or not.

Development, just like in Support service, begins with the creation of a controller and the allocation of basic methods, which we also use to specify the paths (routes) along which the conversion will take place. And everything else depends on variations of implementation. Highlight the main development modules in our service.

First of all, a ticket service is a service with which any users/clients can work, not only the service support clients. Therefore, it is important to implement the authentication of the incoming client. When registering a client, we provide him with a GUID - a unique identifier under which he can contact us in a ticket service. When creating a ticket, only the fact that the client is registered with us or not will be checked. And when working with a specific application, we will check that this application was created by the incoming client, but if not, then the bad request will be returned. Of course, this situation is unlikely only if the data in the database is not corrected manually, but we must be cautioned.

As for the database, everything here is designed to store information about tickets created, messages, customers that we register with us. In addition, we store information about supported support systems. Also, due to the peculiarities of working with GLPI and the fact that we may have several bots that correspond to different projects, we must create separate projects in GLPI and create tickets for each client in this project. Therefore, we still have separate tables for each helpdesk, where we store information about which project corresponds to which client.

Another very important thing is how to find out that the application has been resolved and the answer can be sent to the user. Different support systems have a mechanism such as a webhook, and in the system you can configure this mechanism, which, when decided by an application support officer, will automatically send a request to the ticket service. But, unfortunately, the helpdesk chosen by the management of the company does not have such an opportunity.

Therefore, we had to figure out how we would interrogate the helpdesk about the solved requests. The easiest thing to do was to use a scheduler, and according to a certain schedule we would «ask» the helpdesk and, if the ticket was resolved, send the result to the support, and he would decide there himself which answer came to which user. So we did, we wrote a job, which is launched using the Hangfire Scheduler [4] at regular intervals and does its job.

In addition, we wrote a second job, which is engaged in the creation of unsent tickets in GLPI. Tickets may be able to failed (not sent) if, for example, there was no access to the support service itself or for any other unknown reason.

Working with files

One of the important features that was requested by the first bot users (within the company) is the ability to upload files of various formats: images, documents, etc.

In order to develop this functionality, first it was necessary to carry out a large analytical work:

- figure out how to work with files in Telegram;
- consider which files we allow to upload and their allowable size;
- assess the possibilities of working with files in GLPI;
- consider where to store these files;
- think over new dialogue scenarios.

Let's go from the very beginning - how files are processed in Telegram. When a user sends an image, document or any other media file to the chat, Telegram recognizes it as a Message type, but taking into account its format: Audio, Photo, Document, etc. All types have the same required *file_id*, *file_size* fields, but there are differences, for example, the Document type has a *mime_type* field — data types that can be transferred via the Internet using the MIME standard (for example, image/jpg or application/pdf).

Now we define the acceptable formats and size: in order not to clutter our future storage, we will limit the file size to 5 MB, and take the most common formats - JPEG, PNG and PDF. Why we will not allow to load docx or, for example excel? The answer is simple, all text formats can be converted to PDF, besides this data format is safer to use.

What is such a file? This is a byte array. But when the user sends the file to the chat, we receive only Update — the object that describes the incoming message, that is, we do not have any file at this step, only general information about it. Therefore, we need to get exactly the byte array to send it from the bot to the Ticket Service, and then to the help desk itself.

Getting the file is done in two steps [5]:

1. Make a request to the Telegram API at */bot<bot_token>/getFile* and pass the file_id as a request parameter - here we can receive either an Error Message with an error code or a successful message consisting of file_id, file_size and file_path.

2. The second request will already concern getting the byte array itself - we make a request to the address */file/bot<bot_token>/<file_path>*.

By the *file_path* parameter we can find out the file extension and its mime type, these parameters will be useful to us in the future when we save the file to the repository. Thus, now we know all the information about the file and the file itself. Next, consider the possibility of working with files in GLPI. Initially, it was rather incomprehensible how to attach documents to the application, because there was no clear description of this process in the helpdesk documentation.

During the research, one solution was found: the ability to add an image/document via html - use tags that would allow adding a link to the file: and if it is an image, then it would be fully displayed, and if the document, then it could be downloaded with following the link [6].

This solution was not ideal, because in the first message of the ticket (ticket description), such tags were not displayed at all (GLPI features), that is, just an empty message came. The use of tags was possible only when adding a comment to the application, but if the user sent only the image/document, then first it would be necessary to create a request with an empty description, and then send a comment.

Then another solution was found: GLPI has the Document type, which can be associated with an application. This process consists of the following steps:

1. To begin with, we look at whether we have a created request for the send request (either the user

sent only a message, or the user complements the already created request). If there is no application, then create it.

2. Make a request to the GLPI API at *apirest.php/Document*. Request parameters - the manifest – is a special file that stores information indicating browsers which files should be saved, which should not be saved, and which files should be replaced with some other content, and the file itself should be a byte array.

3. Then do the binding - request to the API at *apirest.php/Document_Item*, as parameters we pass documents_id, items_id (ticket_id) and itemtype - the type of the entity to which we attach the document, namely «Ticket».

After you have completed the steps above, in the application you can see all attachments that have been added by the user. We now turn to the question of storage. For the first implementation of this functionality, it was decided to store documents in a database. In Postgres, for byte data there is a type bytea. In our initial assumptions, this was a good and simple solution. But since the production database is in a cluster, in which not only our database is located, it was necessary to find out if we would cause any harm to neighboring databases.

And in fact, this possibility exists, because if the files are too large and there are just a lot of them, then the cache that should be used for other requests will be clogged. Over time, the database grows, processes that give files clog up a free pool, the load and space used increases.

Then, for reflection, the option of storing files in a container was chosen. Note that our application is deployed in a Docker container [7]. Containers are like directories. Containers contain everything you need for the application to work. Each container is created from an image. Containers can be created, started, stopped, transferred or deleted. Each container is isolated and is a secure platform for the application. In other words, a container is like a separate small running computer.

But this option did not suit us at all, because we restart the container with each update of the service and thus, the data that is stored there is naturally deleted. Even if we take into account the fact that when a user sends a file and clicks «Send», we instantly download the file from Telegram, upload it to our machine and then to GLPI, it’s still possible that while the user sends the document to the chat and click the «Send» button, a long period of time will pass, during which we will restart this container.

The only option is the file sharing. Initially, we were told that it was rather time consuming to raise all this, but later we came to the conclusion that this is the best option, and it is necessary not only for us, but also for other teams in the company. Therefore, we have deployed the file sharing. Interaction with it is very simple - all we need is to upload the file there and upload it on request.

Now it remains to review the concept of dialog with the user when he downloads files. There are two possible behaviors:

- The first one remains exactly the same as when working with regular messages.
- The second - when the data sent by the user exceeds the size or does not correspond to the format and type of data that we support. In this case, it is necessary to send an error message to the user and suggest trying to enter something else.

This scenario can be seen in the next diagram (Figure 3).

GLPI helpdesk

As mentioned earlier, this support system was proposed by the company’s management, so we didn’t have much choice. This helpdesk is pretty good and easy to use. Helpdesk itself was described in [1], but the main points should be briefly recalled.

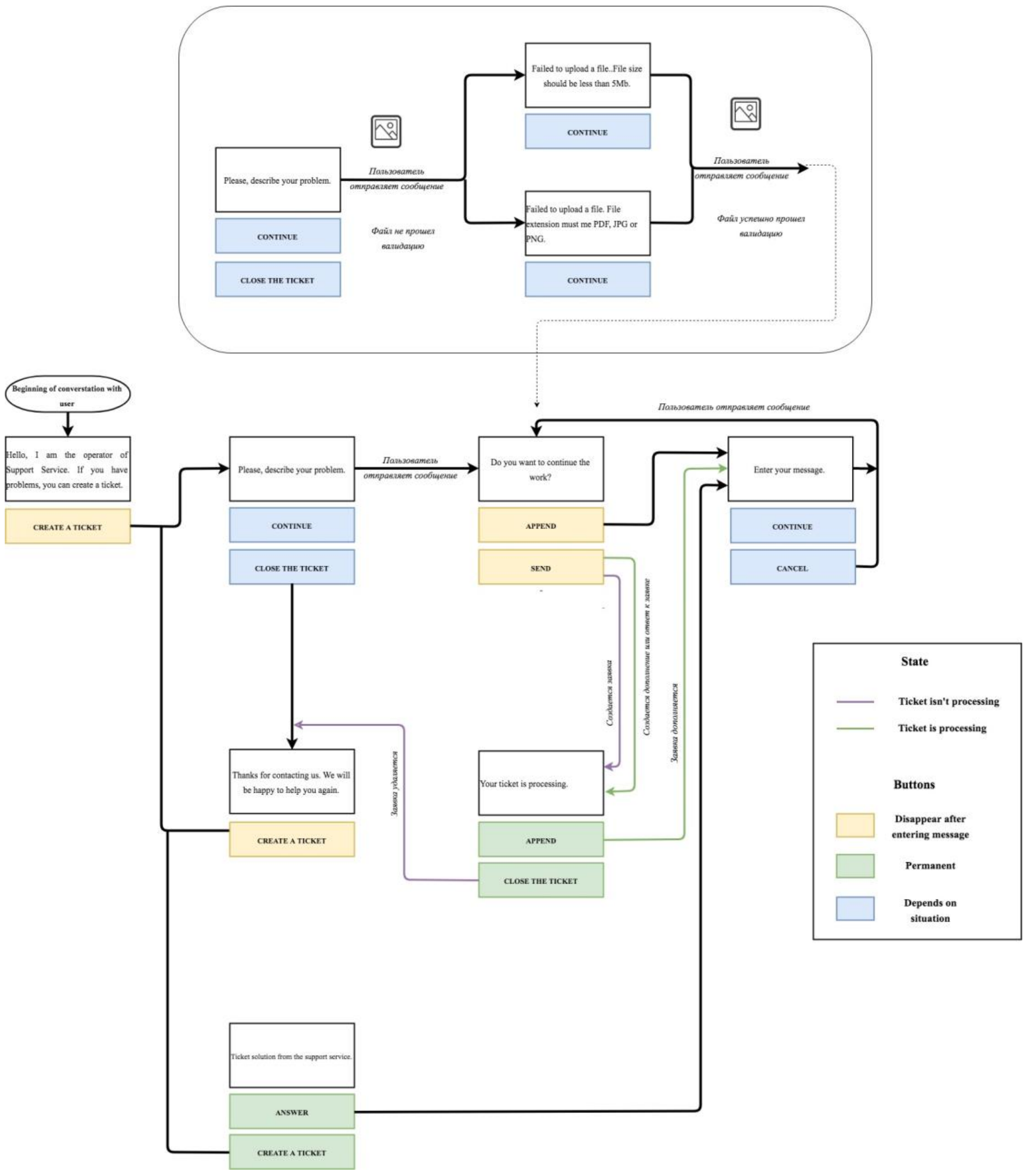
Please, describe your problem.
CONTINUE
CLOSE THE TICKET
Пользователь отправляет сообщение
Файл не прошел валидацию
Failed to upload a file..File size should be less than 5Mb.
CONTINUE
Failed to upload a file. File extension must me PDF, JPG or PNG.
CONTINUE
Пользователь отправляет сообщение
Файл успешно прошел валидацию
Beginning of converstation with user
Hello, I am the operator of Support Service. If you have problems, you can create a ticket.
CREATE A TICKET
Please, describe your problem.
CONTINUE
CLOSE THE TICKET
Пользователь отправляет сообщение
Do you want to continue the work?
APPEND
SEND
Пользователь отправляет сообщение
Enter your message.
CONTINUE
CANCEL
Создается заявка
Создается дополнение или ответ к заявке
Заявка дополняется
Заявка удаляется
Thanks for contacting us. We will be happy to help you again.
CREATE A TICKET
Your ticket is processing.
APPEND
CLOSE THE TICKET
State
Ticket isn't processing
Ticket is processing
Buttons
Disappear after entering message
Permanent
Depends on situation
Ticket solution from the support service.
ANSWER
CREATE A TICKET

Figure 3. Scenario of working with files

GLPI - an abbreviation for the Gestionnaire libre de parc informatique (Free IT Infrastructure Manager), is a system for handling requests and incidents, as well as for inventory of computer equipment (computers, software, printers, etc.) [8].

We introduce the basic concepts for working with the GLPI API.

User token - used in the login process instead of username / password. You can find it in the Personalization → Remote access keys → API token tab.

Session token - the string used in all requests to the GLPI API, describes the session in GLPI.

Application token - an optional parameter by which you can identify access to the API. You can find it in the tab Setup → General → API → API client → Application token.

And we give a description of the main methods of working with the API.

- **Init session**

In order to get started with GLPI, you need to initiate a session — get a session token. This is done through a GET request - initSession.

URL: apirest.php/initSession/

Parameters (Headers):

- App-Token: <app_token>
- Authorization: user_token <user-token>

Response:

- 200 (OK) – parameter «session_token»

- 400 (Bad Request) – error message
- 401 (UNAUTHORIZED) – not authorized

- **Create ticket**

URL: apirest.php/:itemtype/ → apirest.php/Ticket/

Parameters (Headers):

- App-Token: <app_token>
- Authorization: user_token <user-token>

Parameters (JSON):

- input - an object with fields of the type (specifically the ticket) that we create.

Response:

- 200 (OK) – id of created ticket
- 400 (Bad Request) – error message
- 401 (UNAUTHORIZED) – not authorized

- **Cancel ticket (status update)**

If the user does not want his ticket processed, then it is necessary to implement a mechanism for canceling work with it.

URL: apirest.php/:itemtype/:id
→ apirest.php/Ticket/{id}

Parameters (Headers):

- App-Token: <app_token>
- Authorization: user_token <user-token>

Parameters (JSON):

- id – ticket id
- input - an object with fields of the type (specifically, a ticket) that is modified.

Response:

- 200 (OK) – update message
- 400 (Bad Request) – error message
- 401 (UNAUTHORIZED) – not authorized
- **Add comment**

After the user has already created an ticket and tries to appending it, all new messages will be added as comments to this ticket.

URL: apirest.php/:itemtype/ → apirest.php/TicketFollowup/

Parameters (Headers):

- App-Token: <app_token>
- Authorization: user_token <user-token>

Parameters (JSON):

- input - an object with fields of the type that we create.

Response:

- 200 (OK) – id of created comment
- 400 (Bad Request) – error message
- 401 (UNAUTHORIZED) – not authorized

- **Search information about ticket**

After the ticket has been submitted and created in GLPI, it is necessary to periodically find out the status in which it is located.

URL:
apirest.php/search/:itemtype/ → apirest.php/search/Ticket/

Parameters (Headers):

- Session-Token: <session_token>
- App-Token: <app_token>

Parameters (query):

- criteria - an array of different criteria by which the query results are filtered.

Response:

- 201 (OK) - objects that meet the query criteria
- 401 (UNAUTHORIZED) – not authorized

- **Add ticket to project**

Different clients can work with the bot service. At the same time, the service itself can work only with one helpdesk, and then it will be unclear from which client the ticket came and how to solve it correctly (the context will not be clear). Therefore, it is necessary to separate tickets depending on the client. GLPI provides such a tool as projects. Task is created for the project and an application is added to it.

URL: apirest.php/:itemtype/ → apirest.php/ProjectTask_Ticket/

Parameters (Headers):

- Session-Token: <session_token>
- App-Token: <app_token>

Parameters (JSON):

- input - an object with fields of the type that we create. Specifically, here it is necessary to specify the id of the ticket that we want to add to the project, and the task id (task identifier) of this project.

Response:

- 201 (OK) – id of added ticket
- 400 (Bad Request) – error message
- 401 (UNAUTHORIZED) – not authorized

- **Create (upload) document**

Since we enable users to send not only messages, but also files of various formats, it is necessary to store and load these files into a helpdesk system in a convenient format.

URL: apirest.php/:itemtype/
→ apirest.php/Document/

Parameters (Headers):

- Session-Token: <session_token>
- App-Token: <app_token>

Parameters (JSON):

- manifest - a special file that stores information indicating browsers which files should be saved, which should not be saved, and which files should be replaced with some other content.

- byte array - file

Response:

- 201 (OK) - id of added document
- 400 (Bad Request) – error message
- 401 (UNAUTHORIZED) – not authorized

- **Bind ticket and document**

It is not enough just to add a document; you must link the document with a specific ticket so that it appears when you switch to this ticket.

URL: apirest.php/:itemtype/

→ apirest.php/Document_Item/

Parameters (Headers):

- Session-Token: <session_token>
- App-Token: <app_token>

Parameters (JSON):

- input – in the request body we pass documents_id, items_id (ticket_id) and itemtype - the type of entity to which we attach the document, namely «Ticket».

Response:

- 201 (OK)
- 400 (Bad Request) – error message
- 401 (UNAUTHORIZED) – not authorized

Testing

It's no secret that human errors can lead to bugs at all stages of software development, and the consequences can be very different - from minor to catastrophic in production, after which you have to quickly stop the application/site and fix the identified bugs.

Software testing in this case just helps to find and fix these bugs before the product goes into production, thereby reducing the level of risk and improving the quality of the product. They also check the places of the user interface, where the user can make a mistake or misunderstand the output of the program, as well as the system's resistance to malicious actions.

Why is the testing process important [9]?

- Software development process is impossible without quality control of the developed product;
- Software testing process is as integral part of the development process as design;
- Testing allows you to assess the quality of the developed product

Since the developed bot is a commercial product, it should not be allowed to be released without prior testing. Therefore, in the framework of this work, we also did various types of testing. There are main levels of testing that also took place in our project [10]:

- *Unit testing* - testing each atomic functionality of an application separately, in an artificially created environment. It is the need to create an artificial working environment for a specific module that requires a tester to know how to automate software testing, some programming skills. This environment for some unit is created using drivers and stubs.
- *Integration testing* - a type of testing in which the integration of modules, their interaction with each other, as well as the integration of subsystems into one common system are checked for compliance with the requirements. For integration testing, components that have already been tested using unit testing, which are grouped into sets, are used. An example of such testing is the writing of tests for the interaction of the application itself with an external database.
- *System testing* - is software testing performed on a complete, integrated system in order to verify that the system meets the initial requirements, both functional and non-functional.
- *Acceptance testing* - the type of testing conducted at the stage of delivery of the finished product (or finished part of the product) to the customer. The purpose of acceptance testing is to determine the availability of a product, which is achieved by passing test scenarios and cases that are based on the specification of requirements for the software being developed.

Conclusion

This article has analyzed in detail the process of developing the service of support for users of client applications. We considered two different concepts of dialogue and chose the best option for our purposes. Also in the article were painted the main and important parts of the two developed services - Support Bot Service and Ticket Service.

To develop the Support Service Bot, we have studied in detail the work of Telegram, what opportunities it provides for working with files, with regular messages, what mechanisms for developing bots gives developers. To develop the Ticket Service, we studied the internal structure of GLPI, methods of interaction with it through the API, which is provided by GLPI.

We also faced the task of providing users with the ability to attach files of various formats to tickets, so we examined in detail various file storage options, their pros and cons, examined the issue of how Telegram and GLPI work with files.

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