COMP208 - Group Software Project
Ballmer Peak

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Contents

Part I

Design

Chapter 1

Architecture

1.1 Network Architecture

Turtlenet is a centralized service, whereby a large number of clients connect to a single server which provides storage and facillitates communication between clients.

Due to the inherantly limited network size (5-50K users per server depending on percentage of active participants vs consumers and local internet speeds) we reccomend that servers serve a particular interest group or geographic locality.

Clients send messages to, and only to, these central servers. Due to the fact that all messages (except CLAIM messages, see client-server/client-client protocols for details) are encrypted the server does not maintain a databse, it cannot; rather clients each maintain their own local databased populated with such information to which they have been granted access.

When a client wishes to send a message to a person they encrypt the message with the public key of the recipient[1] and upload it to the server. It is important to note that all network connections are performed via Tor.

When a client wishes to view messages sent to them, they download all messages posted to the server since they last downloaded all messages from it and attempt to decrypt them all with their private key; those messages the client successfully decrypts (message decryption/integrity is verified via SHA256 hash) where intended for it and parsed. During the parsing of a message the sender is determined by seeing which known public key can verify the RSA signature.

Due to the nature of data storage in client-local databases, all events and data within the system must be represented within these plaintext messages. This is achieved by having multiple types of messages (see client-client protocol).

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[1]using RSA/AES, see protocol for details

1.2 System Architecture

The system has a number of modules which interact with one another via strictly defined interfaces. Each module has one function, and interacts as little as possible with the rest of the system. The modules and their interactions are shown below. NB: a->b denotes that data passes from module a to module b, and a<->b similarly denotes that data passes both from a to b and from b to a.
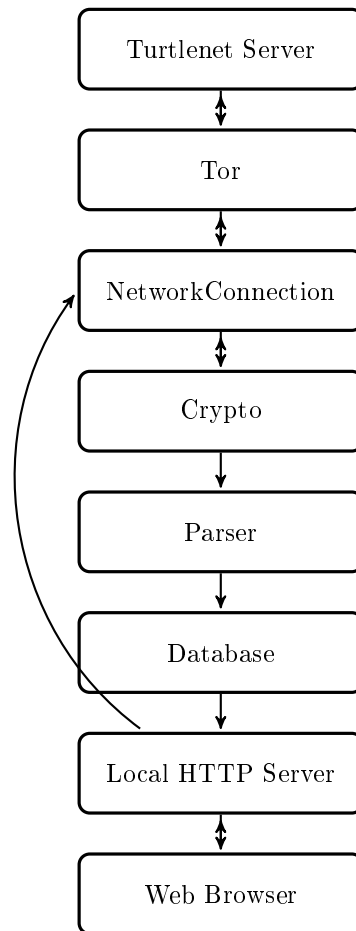
Figure 1.1: Module Interaction

Chapter 2

Data Flow Diagram
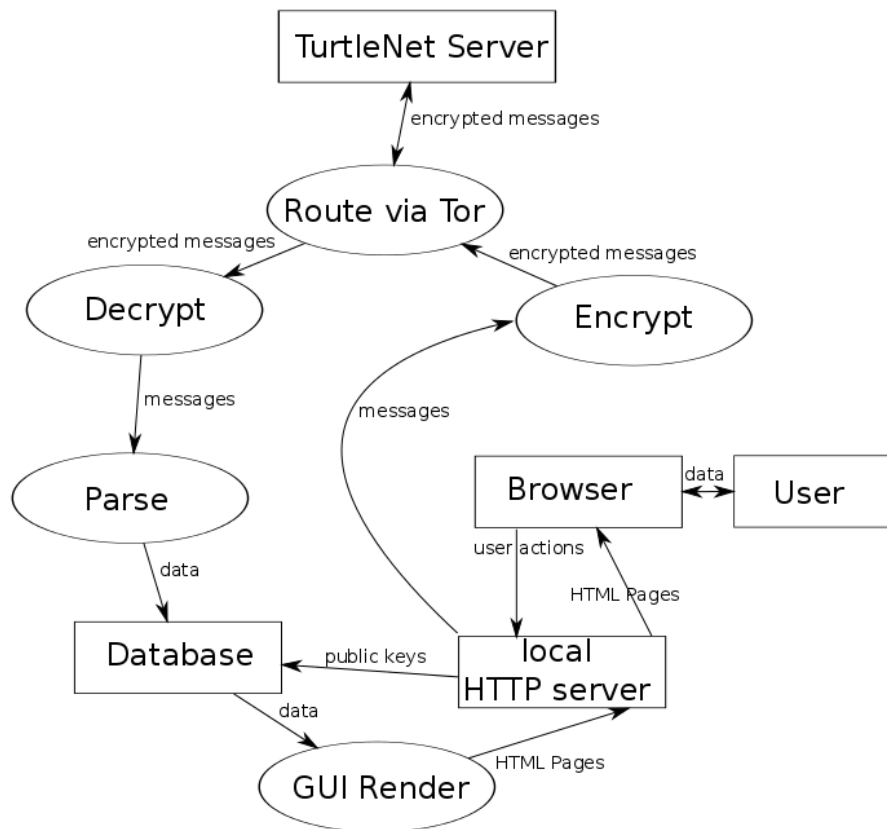
Figure 2.1: Data Flow Diagram

Chapter 3

Use Case Diagrams

System

All

By IP

«extend»

«extend»

«extend»

Time Based

«extend»

«extend»

Specific Message

«extend»

Delete Message

Messages

Join Time

«extend»

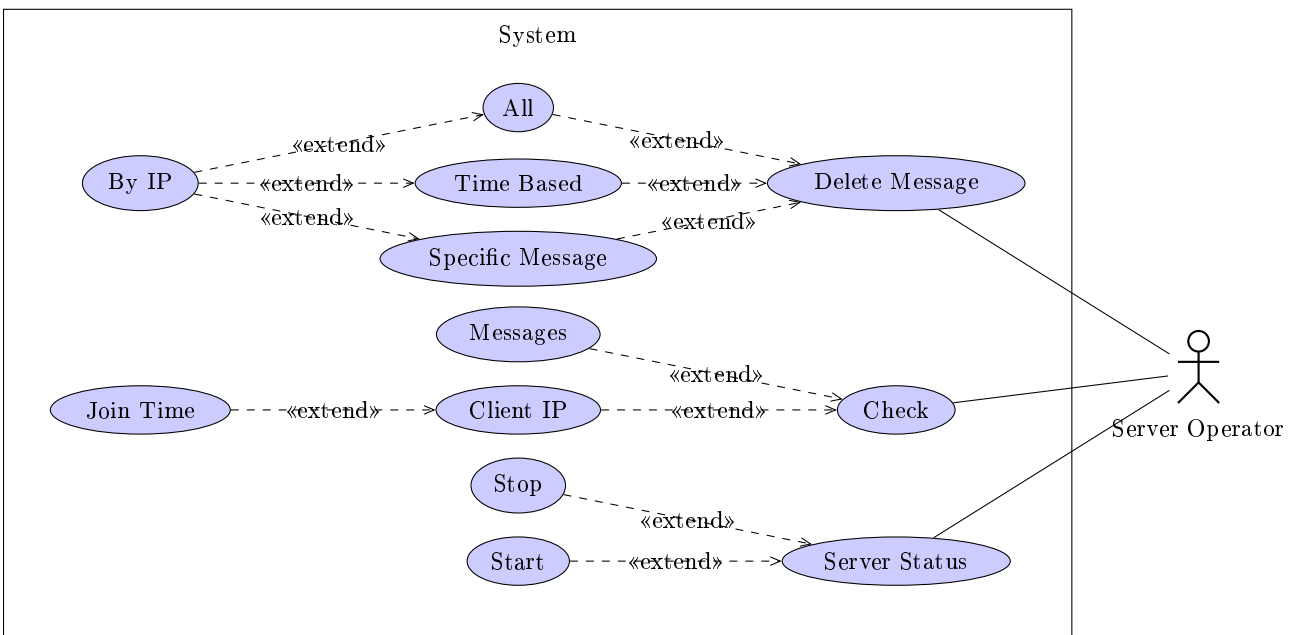Client IP

«extend»

«extend»

Check

Stop

«extend»

Start

«extend»

Server Status

Server Operator
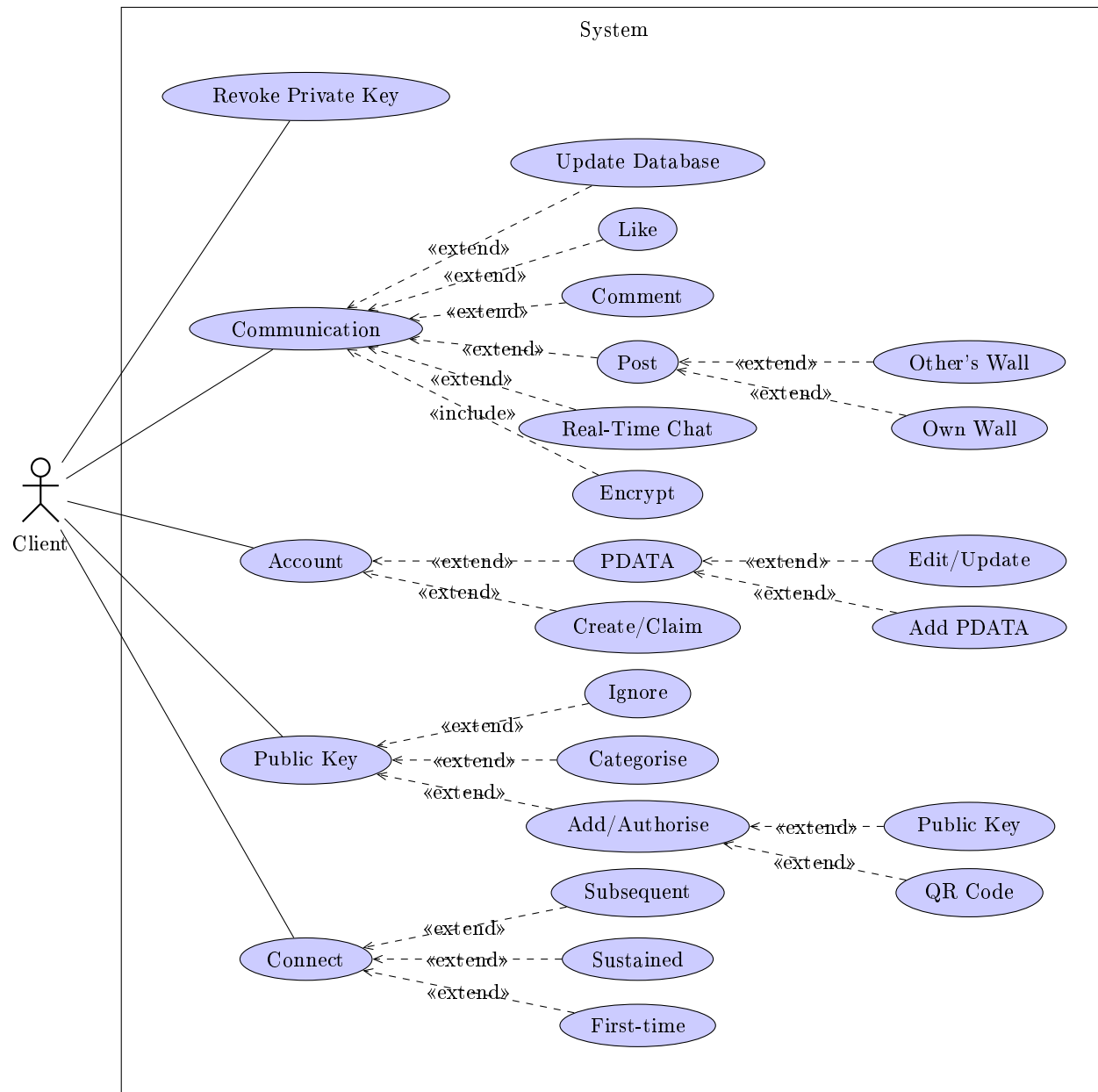
Chapter 4

Protocol

4.1   High Level Summary of Protocol

Creating an account is done by generating an RSA keypair, and choosing a name. An unencrypted (but signed) message is then posted to the server associating that keypair with that name. In this way, by knowing the public key of someone, you may discover their name in the service, but not vice versa.

`pretty dataflow diagram`

Connecting for the first time Every unencrypted message stored on the server is downloaded(signed nicknames and nothing more). At this time the local database contains only signed messages claiming usernames. The public keys are not provided, these are of use only when you learn the public key behind a name. The rationale for not providing public keys is provided in the section regarding adding a friend. Messages posted after your name was claimed will require downloading too, as once you claim a name people may send you messages. It's worth noting that messages from before you connected for the first time are now downloaded because they can not have been sent to you (with a complient client) if someone retroactivly grants you permission to view something they publish it as a new message with an old timestamp; the sole exception to this is when you connect using a new device, in which case all messages since you first claimed a name will be downloaded.

Connecting subsequently The client requests every message stored on the server since the last time they connected up to the present. Decryptable messages are used to update the local DB, others are discarded.

Continued connection During a session the client requests updates from the server every

0.5-5 seconds (configurable by the user).

Adding a friend is performed by having a friend email (or otherwise transfere) you their public key. This is input to the client, and it finds their username (via public posting that occured when registering). You may now interact with that person. They may not interact with you until they recieve your public key. Public key transferal will be performed via exchaning plaintext base64 encoded strings, or QR codes. The user will be prompted, after retrieving the username of the user, to catagorise them.

Talking with a friend or posting on your wall is achieved by writing a message, signing it with your private key, and encrypting one copy of it with each of the recipiants public keys before posting it to the server. The client prevents one from posting a message to someones public key if they have not claimed a nickname.

Posting to a friends wall, commenting and liking may be requested by sending a EPOST/CMNT/LIKE message to the friend (upon whose wall/post you are posting, commenting or liking), when that friend logs in they will recieve your request and may confirm or deny it. If they confirm then they take your (signed) message and transmit it to each of their friends as previously described. Given that authentication is entirely based on crypto signatures it doesn't matter that your friend relays the message.This is required because it is impossible for one to know who is able to see the persons wall, post, or comment upon which you seek to post, like, or comment.

4.2   Client-Server Protocol

The client-server architecture is neccessarily simple.

The client connects to the server, sends a single command, receives the servers response and then disconnects. The following shows commands sent by the client, and the servers action in response.

command	purpose	servers action
t	get the server time	sends back the current time (unix time in milliseconds)
s *utf-8_text*	send messages	the text sent is stored on the server
get *ms_unix_time*	get new messages	every message stored since the given time is sent
c *utf-8_text*	claim a username	the text sent is stored on the server, with a special filename

Table 4.1: Client-Server Protocol

Every command is terminated with a linefeed. Every response from the server will be terminated with a linefeed. The last line sent by the server will always be "s" for success, or "e" for failure (this is ommitted from the above table).

CLAIM messages (sent with c) will be parsed by the Message class and the username extracted for use in a filename. The filename of claim messages is as follows *<unix_time_in_ms>_<username>*; the filename of all other messages is as follows *<unix_time_in_ms>_<SHA256_hash>*.

4.3 Client-Client Protocol

4.4 Summary

All client-client communication is mediated by the server. When one client wishes to send a message to another it encrypts the message with the public key associated with the recipient and uploads it to the server. When one client wishes to recieve a message it downloads all new messages from the server and parses those it can decrypt. This is performed in order to hide who recieves a message. All messages except CLAIM messages are encrypted. Multiple recipients imply multiple messages being uploaded, this is taken for granted in the text which follows.

consider computational cost of seperating RSA header and AES messa

4.5 Message Formatting

4.5.1 Unecrypted Messages

Messages have a command (or type), which specifies the nature of the message; messages have content, which specifies the details of the message; messages have an RSA signature, which authenticates the message; messages have a timestamp, which dates the message down to the millisecond, the time format is unix time in milliseconds.

Messages are represented external to the system as utf-8 strings, and internally via the Message class. The string representation is as follows:

$$<command>\backslash<signature>\backslash<content>\backslash<timestamp>$$

Backslashes are literal, angle brackets denote placeholder values where data specific to a message is placed.

An example follows:

$$POST\backslash<signature>\backslash Hello, World!\backslash 1393407435547$$

backslashes in message content are escaped with another backslash, signatures are base64 encoded SHA256/RSA signatures of the content of the message concatenated with a decimal string representation of the timestamp. All text is encoded in UTF-8.

Missing
figure   Diagram from wiki page

4.5.2   Encrypted Messages

Encrypted messages contain the AES IV's; the RSA encrypted AES key; and the AES encrypted
message.

Messages are encrypted by encoding the entire message to be sent with UTF-8; encrypting the
message with a randomly generated AES key; encrypting the AES key with RSA; encoding the
RSA encrypted AES key in base64; encoding the (random) AES initialization vectors in base64 and
concatenating these three parts with a backslash between each. The format follows:
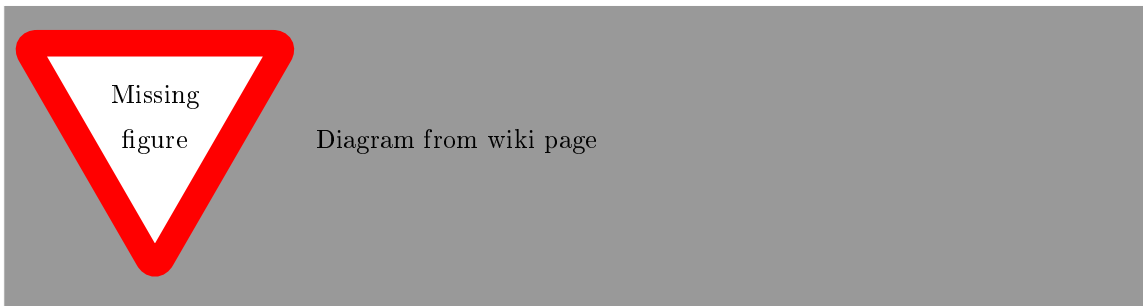
$$<AES\ IV>\backslash<RSA\ encrypted\ random\ AES\ key>\backslash<AES\ encrypted\ message>$$

Backslashes are literal, angle brackets denote placeholder values where data specific to a message
is placed.

Missing
figure   Diagram from wiki page
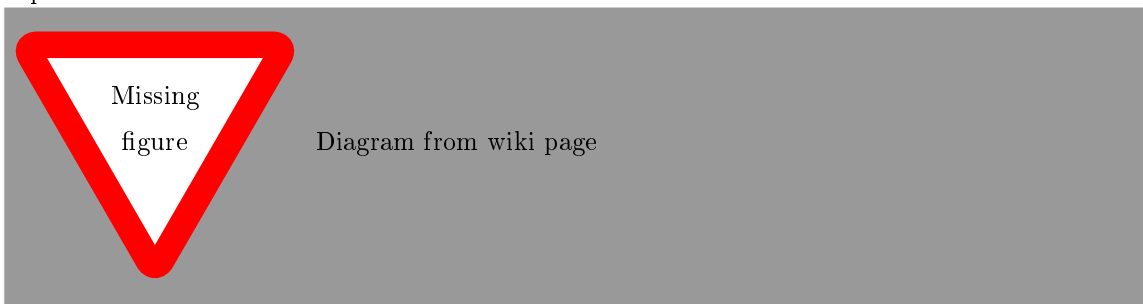
4.6   Claiming a Username

Each user (keypair) should claim one username. Uniqueness is enforced by the server, and so not
relied upon at all. Usernames are useful because public keys are not human readable. In order
to claim a username, one must sent an unencrypted CLAIM message to the server. The format
follows:

CLAIM\$<signature>$\$<username>$\$<timestamp>$

4.7 Revoking a Key

If a users private key should be leaked, then they must be able to revoke that key. This is done by sending a REVOKE message to the server. All content signed by the private key after the stated time will be flagged as untrusted. The format follows:

REVOKE\$<signature>$\$<time>$\$<timestamp>$

4.8 Profile Data

Users may wish to share personal details with certain people, they may share this information via profile data. Profile data is shared using PDATA messages. A PDATA message contains a list of fields, followed by a colon, followed by the value, followed by a semicolon. The format follows:

PDATA\$<signature>$\$<values>$\$<timestamp>$

The format for values follows:

$<field>$: $<value>$; ...

An example follows:

PDATA\$<signature>$\name:Luke Thomas;dob:1994;\$<timestamp>$

4.9 Inter-User Realtime Chat

Users can chat in in real time, this by achieved by sending a CHAT message to all people you wish the include in the conversation. This message includes a full list of colon delimited public keys involved in the chat. The format follows:

CHAT\$<signature>$\$<keys>$\$<timestamp>$

The format for keys follows:

$<key>$: $<another\_key>$...

An example follows:

CHAT\$<signature>$\$<key1>$:$<key2>$\$<timestamp>$

Following the establishment of a conversation, messages may be added to it with PCHAT messages, the format follows:

$$PCHAT \backslash <signature> \backslash <conversation>:<message> \backslash <timestamp>$$

Whereby $<conversation>$ denotes the signature present on the establishing message. An example follows:

$$PCHAT \backslash <signature> \backslash 9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08:First! \backslash <timestamp>$$

4.10   Posting to own wall

When a user posts to their own wall they upload a POST message to the server of the following format.

$$POST \backslash <signature> \backslash <message> \backslash <timestamp>$$

The format of message is merely UTF-8 text, with backslashes escaped with blackslashes.
An example follows which contains the text "Hello, World!", a newline, "foo \bar\baz":

$$POST \backslash <signature> \backslash Hello, World!$$
$$foo \backslash \backslash bar \backslash \backslash baz \backslash <timestamp>$$

4.11   Posting on anothers wall

A user may request to post on a friends wall by sending them an FPOST message, the poster may not decide who is able to view the message. The format is identical to that of a POST message, except for the command and singular recipient. An example follows:

$$FPOST \backslash <signature> \backslash Hello, World! \backslash <timestamp>$$

Upon recipt of an FPOST message the friend is prompted by the client to choose whether or not to display it, and if so who may view it. Once this is done the friend reposts the message with the command changed to POST instead of FPOST as they would post anything to their own wall. This works because authentication is entirely based on RSA signatures so in copying the original signature the friend may post as the original author provided they don't alter the message (and thus its hash and required signature).

4.12 Commenting

Commenting works simiarly to posting on anothers wall, so an explanation of details of how it occurs is not provided (see prior section). The only difference is the format of a CMNT message from an FPOST message. The format of a CMNT message is as follows:

$$\text{CMNT} \backslash <signature> \backslash <hash>: \; <comment> \backslash <timestamp>$$

Where $<hash>$ denotes the hash of the post or comment being commented upon. An example comment follows:

$$\text{CMNT} \backslash <signature> \backslash 9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08:$$
$$\text{Yeah, well, that's just like, your opinion, man.} \backslash <timestamp>$$

4.13 Liking

Like messages are identical to comments except for the command and the the fact that no ":$<comment>$" follows the hash. An example like follows:

$$\text{LIKE} \backslash <signature> \backslash 9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08 \backslash <timestamp>$$

Chapter 5

Class Interfaces

5.1   Class Interfaces

The following is a description of the public functions of all public classes. Many classes have inner private classes they use for conveinience, however to simplify interaction between parts of our system ('modules') we have very few conveinience classes.

function	description
void main()	starts the server

Table 5.1: Server

function	description
void main()	constructs and starts all nececary classes and threads, runs the main loop

Table 5.2: Client

concile return types
stated public classes

ify what's static

ver DB interface with
guys and aishiah

20

function	description
NetworkConnection()	Constructs a NetworkConnection and connects to the given URL (through tor)
void run()	periodically download new messages until asked to close, downloaded messages are stored in a FIFO buffer
void close()	kills the thread started by run()
boolean hasMessage()	return true if there is a message in the buffer, false otherwise
String getMessage()	return the oldest message in the buffer
boolean claimName()	claim a given username, returns true on success, false otherwise
void revokeKeypair()	revokes your keypair
void pdata()	adds or updates profile infomration
void chat()	begins or continues a conversaion
void post()	post a message to your wall
void fpost()	post a message to a friends wall
void comment()	comment on a comment or post
void like()	like a comment or post

Table 5.3: NetworkConnection

5.2   Class Diagram

Missing figure   Class Diagram Goes Here

function	description
boolean keysExist()	return true if the user has a keypair, false otherwise
void keyGen()	generate a keypair for the user
PublicKey getPublicKey()	returns the users public key
PrivateKey getPrivateKey()	returns the users private key
String sign()	returns an RSA signature of the passed string
boolean verifySig()	returns true if author signed msg, false otherwise
String encrypt()	returns an encrypted message constructed from the passed parameters
Message decrypt()	decrypts the passed string, returns the appropriate message, on failure a NULL message is returned
String base64Encode()	base64 encodes the passed data, returns the string
byte[] base64Decode()	base64 decodes the passed data, returns the byte[]
String encodeKey()	encodes a public key as a string, returns that string (X509)
PublicKey decodeKey()	decodes a public key encoded as a string, returns that public key(X509)
String hash ()	returns the SHA256 hash the the passed string as a hex string
int rand ()	returns a pseudorandom value $<=$ max and $>=$ min

Table 5.4: Crypto

function	description
void parse()	parses a sting message, records parsed data in the database

Table 5.5: Parser

function	description
PublicKey getPublicKey()	returns the public key associated with the username
String getUsername()	returns the username associated with a public key
Post[] getPosts()	returns posts posted with given timeframe (unix time in milliseconds)
Comment[] getComments()	returns all comments on the given post
Like[] getLikes()	returns all likes on the given post or comment
Conversation getConversation()	returns a given conversaion
addFriend()	adds the given friend to the DB
addCategory()	adds a new category to the DB
addToCategory()	adds a user to a category

Table 5.6: Database

function	description
GUIServer()	Constructs a GUIServer
void run()	continually updates the GUI from the DB
void close()	kills the GUIServer thread
boolean isRunning()	returns true if the GUIServer is running, false otherwise

Table 5.7: GUI

function	description
Message()	Consturcts a message with given data
Message parse()	parses the string representation of a message into a message
String toString()	creates a string representation of the message
String getCmd()	returns the type of message
String getContent()	returns the content of the message
String getSig()	returns the RSA signature on the message
long getTimestamp()	returns the timestamp on the message

Table 5.8: Message

Chapter 6

Pseudocode

important functions,
/paste from java and

Chapter 7

Database

7.1 Database execution

In this section, we go through the execution methods of the database based on the transactions that have been carried out within the system. This also shows where the data is expected to roughly end up, however this will be explained in greater detail along with the diagrams which will be found later in this document.

Stakeholders and users have to be aware that due to lightweight database files are stored locally in each users' computer, there are a number of databases involve when the transactions are carried out. The reason why it is designed this way is to ensure and avoid any malicious activities conducted especially by the server.

7.1.1 User adds post, comment and event

When a user adds a content into Turtlenet such as posts, comments and events, the system is expected to capture these details and add them into its respective tables. The database system is expected to log the posts, comments and events by capturing the time and date when the transaction is carried out.

7.1.2 User creates and sends message to another user

As when the user creates a message then sends it, the database system is expected to store the message and log it by recording its date and time of which the message is sent. Other details like the reciever's user_id are inserted into the database well.

7.1.3   User sends a friend request to another user

When the user sends a request to others, this request will be sent and the details will be captured and recorded into the other user's local database file under the friend request table. This will be stored in this table until which the user decides to either accept or reject the invitation.

7.1.4   User receives a friend request from another user

Another situation with the friend request is when a user receives a friend request, this time the information such as the public key will be recorded into the user's local database until which the user decides to do something either accept or reject it.

7.1.5   A user adds a relation

When a user adds a relation, the details of this related user will be captured, such as his profile, and will be added into the users table. From then on, the user can see his relation's profile information.

7.1.6   User receives a message

As the user receives a message, it will be stored in the message table along with other details such as the date and time, and the sender's details.

7.1.7   User receives a friend request

The user will be notified when a friend request is sent. The details of the person who sends the request will be recorded in the database. The user has two options to deal with a friend request, either to accept or reject it. Once it is accepted, the profile details of the sender will be stored in the user's local database, same goes to the user's details store on the sender's local database.

7.2 Table layout of the database

NB: Public keys are 217 characters long, all id's are auto-incremented.

Table 7.1: you

Name	Datatype	Key
username	VARCHAR(25)	PK
name	VARCHAR(30)	
birthday	DATE	
sex	VARCHAR(1)	
email	VARCHAR(30)	
public_key	VARCHAR(8)	

Table 7.2: user

Name	Datatype	Key
user_id	VARCHAR(8)	PK
username	VARCHAR(25)	
name	VARCHAR(30)	
birthday	DATE	
sex	VARCHAR(1)	
email	VARCHAR(30)	

Table 7.3: is_in_category

Name	Datatype	Key
is_in_id	INT(10)	PK
category_id	INT(10)	FK
user_id	INT(5)	FK

Table 7.4: category

Name	Datatype	Key
category_id	INT(10)	PK
name	VARCHAR(30)	

Table 7.5: private_message

Name	Datatype	Key
message_id	INT(10)	PK
from	VARCHAR(8)	
to	VARCHAR(8)	
content	VARCHAR(50)	
time	DATE	

Table 7.6: wall_post

Name	Datatype	Key
wall_id	INT(10)	PK
from	VARCHAR(8)	FK
to	VARCHAR(8)	FK
permission_to	VARCHAR(8)	FK
content	VARCHAR(50)	
time	DATE	

Table 7.7: has_comment

Name	Datatype	Key
comment_id	INT(10)	PK
post_id	INT(10)	FK
user_id	VARCHAR(8)	FK
comment_time	DATE	

Table 7.8: has_like

Name	Datatype	Key
like_id	INT(10)	PK
post_id	INT(8)	FK
user_id	VARCHAR(8)	FK

Table 7.9: events

Name	Datatype	Key
event_id	INT(10)	PK
title	VARCHAR(10)	
content	VARCHAR(40)	
from	VARCHAR(8)	FK
permission_allowed_to	VARCHAR(8)	FK

Table 7.10: friend_request

Name	Datatype	Key
public_key	VARCHAR(8)	PK
request_time	DATE	
request_react	VARCHAR(10)	

Table 7.11: login_logout_log

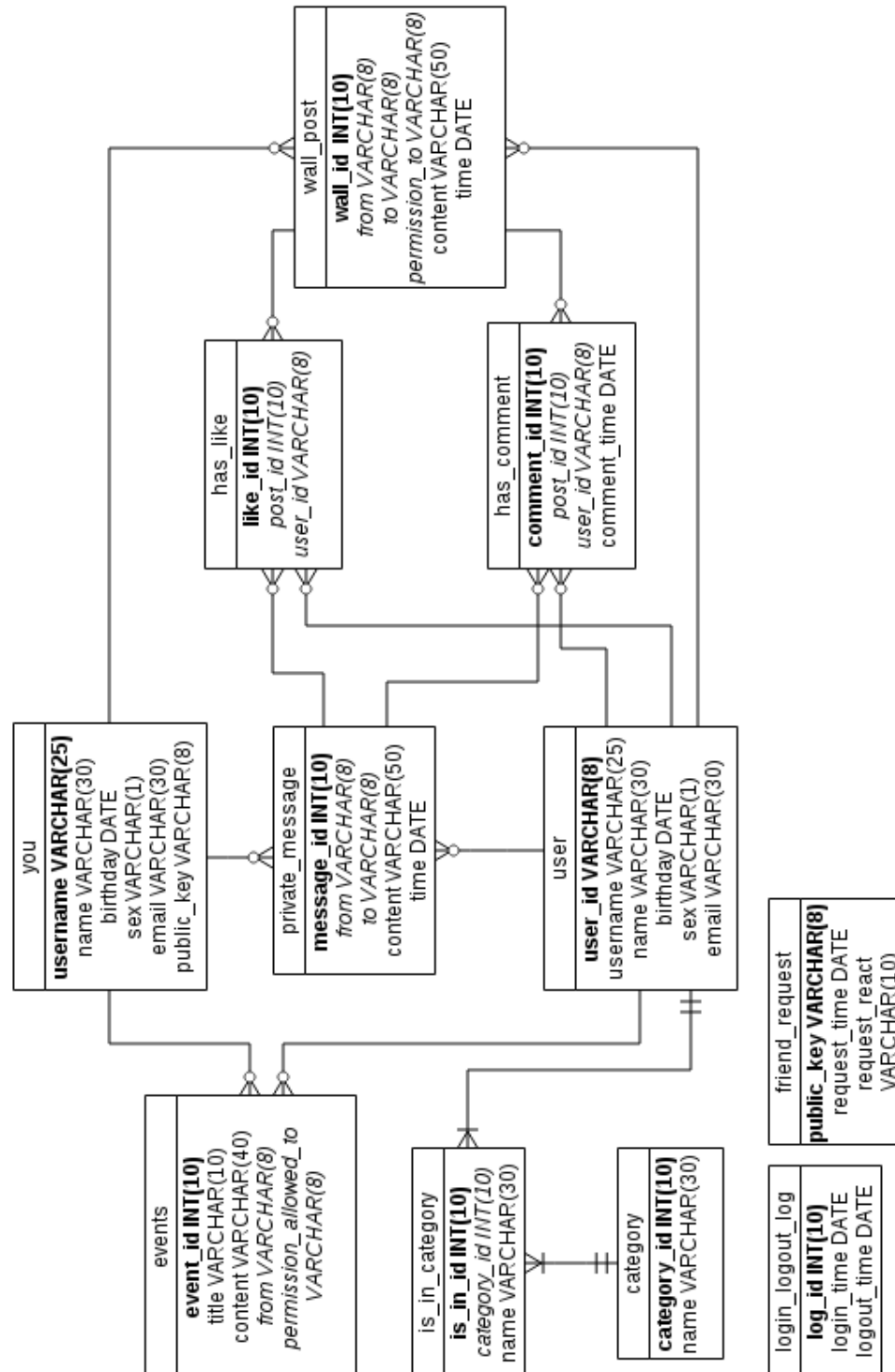| Name	Datatype	Key
log_id	INT(10)	PK
login_time	DATE	
logout_time	DATE	

Figure 7.1: Database Entity Relationship diagram

Chapter 8

Transaction details

- the transactions involved for each user activity

- how these data are used

- 3 categories

  - data entry

  - data update and deletion

  - data queries

- transaction should be related to user view, ensure all functions are supported

8.1 data entry

field	notes
username	user is to make his own username
name	user is to enter his name (first and last name)
birthday	user enters his date of birth by selecting the date from a calendar
sex	user is to select either his/her sex, male or female
email	user is to enter his email address

Table 8.1: User enters his profile information

user_id's and post_id's are local and don't exist outside the DB

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field	notes
message_id	id is to be incremented when a new message is initiated
from(user_id)	system is to insert the user_id of whoever initiated the message
to(user_id)	user is to select the person whom he wants to send the message to
content	content of the message which the user intends to send to the receiver
message_times_date	the time and date is recorded of which the message is sent to the receiver

Table 8.2: User starts a new conversation by adding a new message

field	notes
post_id	id is to be incremented when a new post is added
permission_allowed_to	user is to choose specific users (he knows) to view his post
from	system is to insert the creator's name of the post
to	the user_name of the post is inserted if the user directs this post to specific person(s)
comment_id	comment_id lists down the comment made out from other users
content	the content of the post
message_time_date	the time and date is recorded of which the post is created

Table 8.3: user adds a new post

field	notes
event_id	id is to be incremented when a new event is added
title	title of the event
content	content of the event
from	the user_id of the person who posted the event
permission_allowed_to	user is to choose specific users (he knows) to view his event

Table 8.4: user adds a new event

field	notes
comment_id	
post_id	
comment_from	
comment_time_ date	

Table 8.5: user adds a comment

field	notes
like_id	
post_id	
like_from	

Table 8.6: user likes a post

Chapter 9

User Interfaces

As a social network, the user interface design is of high importance, as a lot of users of the program will have little core system knowledge, and rely entirely on the user interface. As a result we have looked at a variety of options into designing which will be the best for the project.

9.1 Swing

Swing is the primary Java GUI toolkit, providing a basic standpoint for entry level interface designing. Introduced back in 1996, Swing was designed to be an interface style that required minimal changes to the applications code, providing the user with a pluggable look and feel mechanism. It has been apart of the standard java library for over a decade, which, as I will now explain, may not be to our benefit.

Swing, whilst an excellent language to begin with, and write simple applications in, is quite dated. As our group advisor put it when inquiring about what we would be coding the user interface in:

> "You should avoid Swing to prevent it looking like it was done in the seventies." - Sebastian Coope

Sebastian is not wrong either, as Swing does a very plain feel to it. "Fig ???" shows an old instant messaging system written with Swing by one of our team members. As you can see it is unlikely to appeal to the mass market with such visually plain appearance. This makes Swing, unlikely to be our GUI toolkit of choice, despite some of our members experience with it.

9.2 Abstract Window Toolkit

Abstract Window Toolkit (otherwise known as AWT), was another choice given that we are programming in Java, and synchronicity between the two would be an advantage. Whilst AWT retained some advantages such as its style blending in with each operating system it runs on, it is even older than Swing being Java's original toolkit, as per such making it redundant for this project.

> s 18 years older, we're
> g to need a better rea-
> about how it's wierd
> users, web tech is more
> eloped for this type of
> ication, or something

9.3 Standard Widget Toolkit

Standard Widget Toolkit (otherwise known as SWT), is one of the more promising candidates so far given its look and up-to-date support packages. The latest stable release of SWT was only last year, and is capable of producing programs with a modern and professionally built appearance, as shown in "Fig ???".

Unlike both Swing and AWT, SWT is not provided by Sun Microsystems as a part of the Java platform. It is now provided and maintained by the Eclipse Foundation, and provided as a part of their widely used Eclipse IDE, something a lot of the team is familiar with.

9.4 GWT

GWT allows you to create HTML/Javascript based user interfaces for Java applications running locally. The interface is programmed in Java and then GWT creates valid HTML/Javascript automatically. A web server is required in order for Javascript events to be sent to the Java application.

The user can then interact with the system by pointing their web browser at localhost. This has the benefit of being familiar to novice users as most modern computer interaction is done within a web browser.

Another advantage of using GWT is the ability to alter the appearance of web pages using CSS. This facilitates the creation of a modern, attractive user interface that integrates nicely with current operating systems and software.

9.5 Javascript

It is possible to create the entire client application in Javascript and use a HTML/Javascript GUI. This approach removes the need for a local web server meaning the only software the user is required to run is a modern web browser.

Another advantage would be tight integration between the logic and interface elements of the client application and no risk of errors caused by using multiple programming languages.

One disadvantage of this approach is the difficulty in implementing the required security measures and encryption in Javascript. This can be remedied by using a Javascript library such as the Forge project which implements many cryptography methods.

The main disadvantage is that in this approach the server operator has complete control of the client the user uses. This is unacceptable because we're assuming that the server operator is seeking to spy on the user.

Chapter 10

QR

I've found a website that generates QR Codes - both professionally and otherwise for free. We could implement it into our prgram by having the program output the URL it gives you as because it's generated via URL, we should be able to store it in a string and then output either that or have an image viewer in the program to output the actual image, whichever is easiest for the user.

The website's create function: http://goqr.me/api/doc/create-qr-code/ The website's read function: http://goqr.me/api/doc/read-qr-code/ A test one I did: https://api.qrserver.com/v1/create-qr-code/?size=300x300&data=%3Ci'mThePublicKeyVariable%3E&format=svg

Appendices

Appendix A

Deadlines

- **2014-01-31** topic and team

- **2014-02-14** requirements

- **2014-03-14** design

- **2014-05-09** portfolio & individual submission

Appendix B

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B.6   Included Works

We did not write or create the following:

- writeup/latex/tikz-uml.sty

- writeup/latex/todonotes.sty

- writeup/latex/ulem.sty

- writeup/images/appendicies/licence.png (CC0 licence logo)

- The CC0 licence text

- client/web_interface_mockup/jquery.js

- client/web interface mockup/turtles.ttf

Appendix C

TODO

C.1 General

Errors shouldn't just display a message, they should be properly handled Get a real DB
REVOKE claims and messages after a certain date if private key leaked
escape backslashes in message content
chang all references to ascii text to UTF-8 text

C.2 Requirements Weeks 1-3

1. Project Desc.

- **COMPLETE** Project being done for (Peter)

- **COMPLETE** Mission Statement (Luke)

- **COMPLETE** Mission Objective (Luke)

- **COMPLETE** Threat Model (Luke)

2. Statement of Deliverables

- **COMPLETE** Desc. of anticipated documentation (Luke)

- **COMPLETE** Desc. of anticipated software (Aishah)

- **COMPLETE** Desc. + Eval. of any anticipated experiments + blackbox (Louis)

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- **COMPLETE** User view and requirements (Luke)

- **COMPLETE** System requirements (Luke)

- **COMPLETE** Transaction requirements (Aishah)

3. Project and Plan

- **COMPLETE** Facebook research (Leon)

- **COMPLETE** Case Study: Tor (Luke)

- **COMPLETE** Case Study: alt.anonymous.messages and mix networks (Luke)

- **COMPLETE** Case Study: PGP and E-Mail (Luke)

- **COMPLETE** Implementation Stage (Peter)

- **COMPLETE** Milestone Identification (Milestones can most easily be recognised as deliverables) (Mike)

- **COMPLETE** Gantt Chart (Mike)

- **COMPLETE** Risk Assessment (Mike)

4. Bibliography

- **COMPLETE** Bibliography framework (Luke)

- **COMPLETE** Add citations where relevent (Everyone, in their own sections)

C.3   Design Weeks 4-X

- **DRAFTED** Use Case Diagram (Mike)

- **DRAFTED** Data Dictionary (Mike)

- **NOT IN PDF** Mobile GUI Design (Leon)

- **NOT IN PDF** Sequence Diagram (Leon)

- **NOT IN PDF** HTML GUI Design (Louis)

- **DRAFTED** DB Design (Aishah)

- **DRAFTED** Transaction Design (Aishah)

- **INCOMPLETE** Server GUI Design (Peter)

- **DRAFTED** Class Interfaces (Luke)

- **DRAFTED** Protocol (Luke)

- **DRAFTED** Architecture (Luke)

- **DRAFTED** Data Flow Diagrams (Luke)

- **NOT IN PDF** Pseudocode (Luke)

- **INCOMPLETE** Class Diagram (???)

Appendix D

Bugs

- The 'DB' allows adding a friend multiple times, no reason to fix because the whole thing needs rewriting as a real DB anyway

Todo list