COMP208 - Group Software Project
Ballmer Peak

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March 13, 2014

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Part I

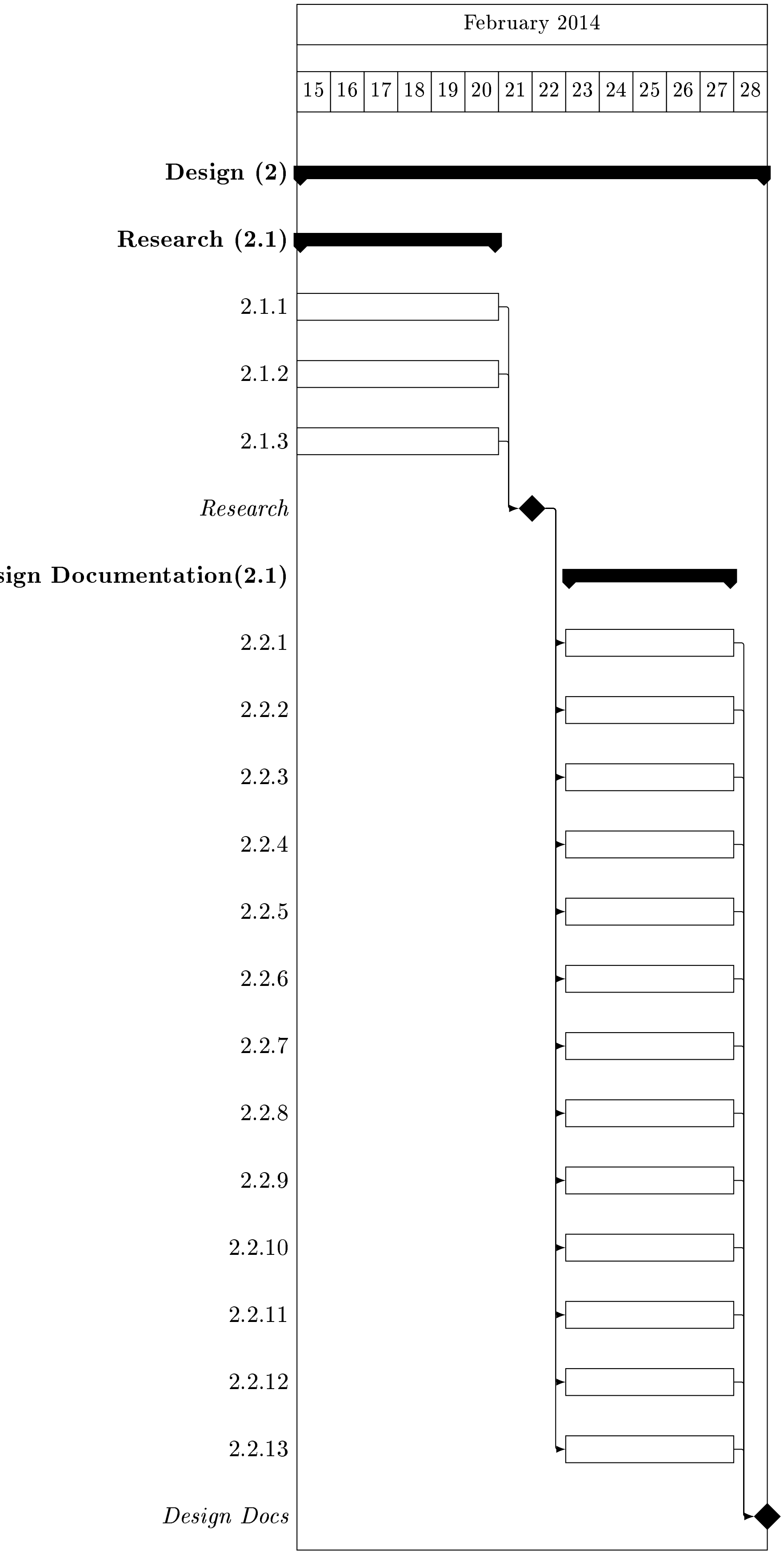
Design

Chapter 1

Proposal Summary

These are excerpts from the Gantt charts made during the requirements stage of the project. They have been used as a guide throughout the completed sections of the project. As the design section was foreseen as the most work-intensive part that is encompassed within the project, particular care and attention was made to make sure that official deadlines were met, through the use of un-official end dates for each task.

By doing so, therefore finishing tasks earlier than required, it has provided a buffer used for quality controlling the project's deliverables.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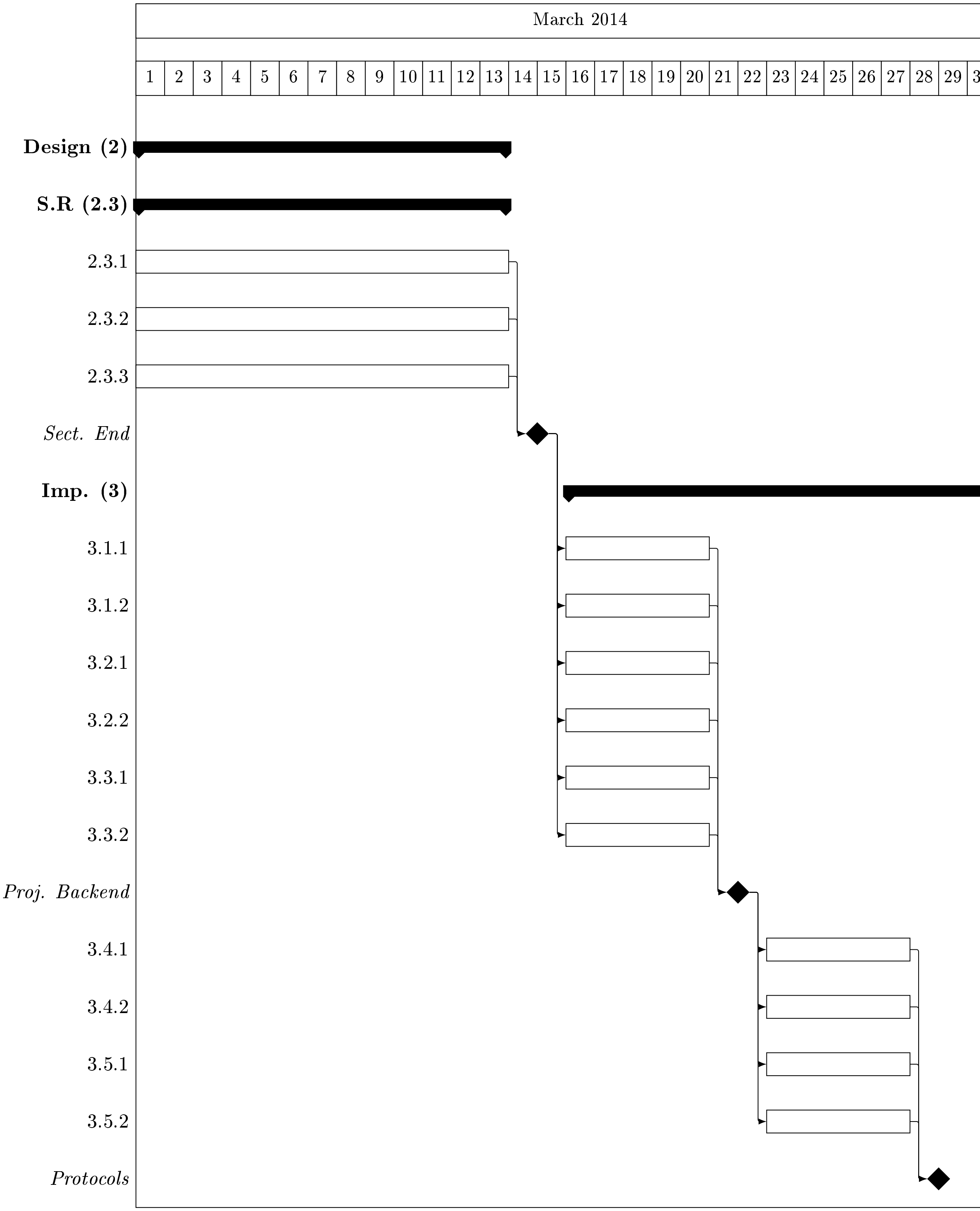
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Chapter 2

Architecture

2.1 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).

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

2.2 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.

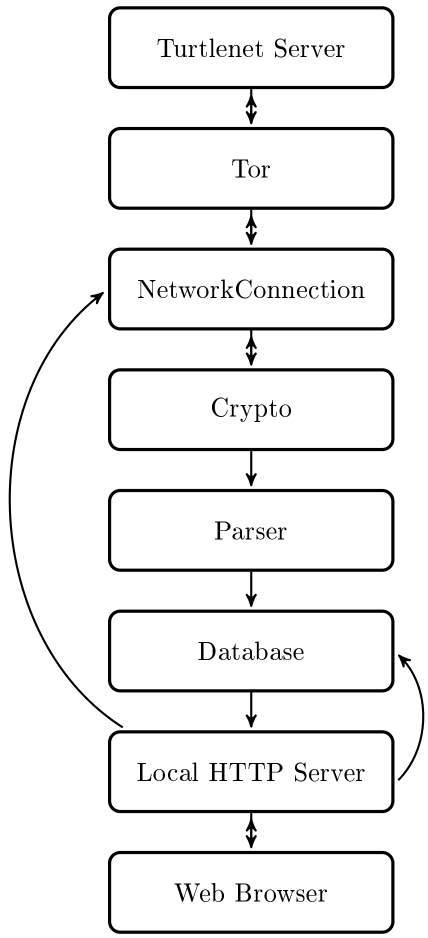


Figure 2.1: Module Interaction

Chapter 3

Data Flow Diagram

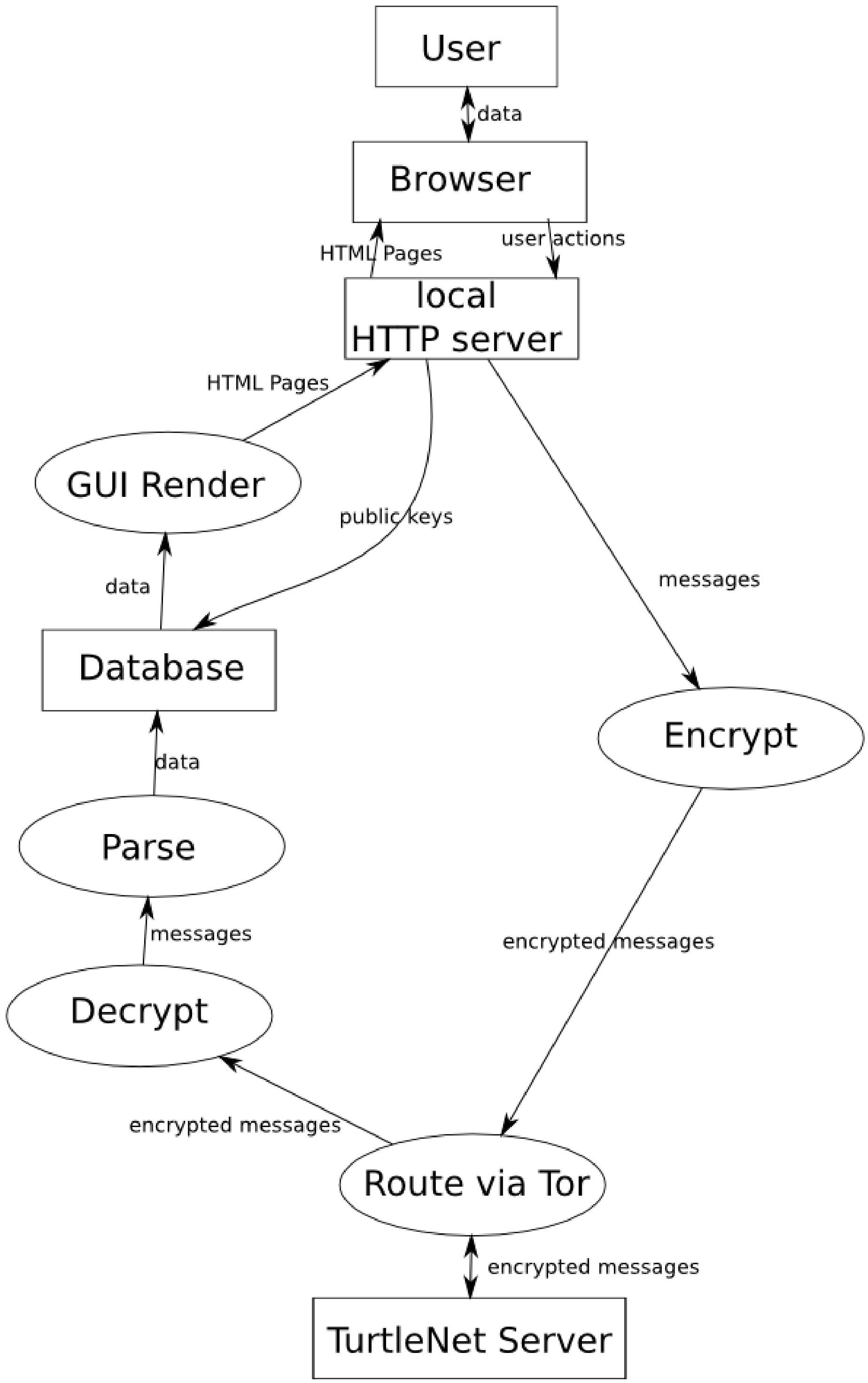
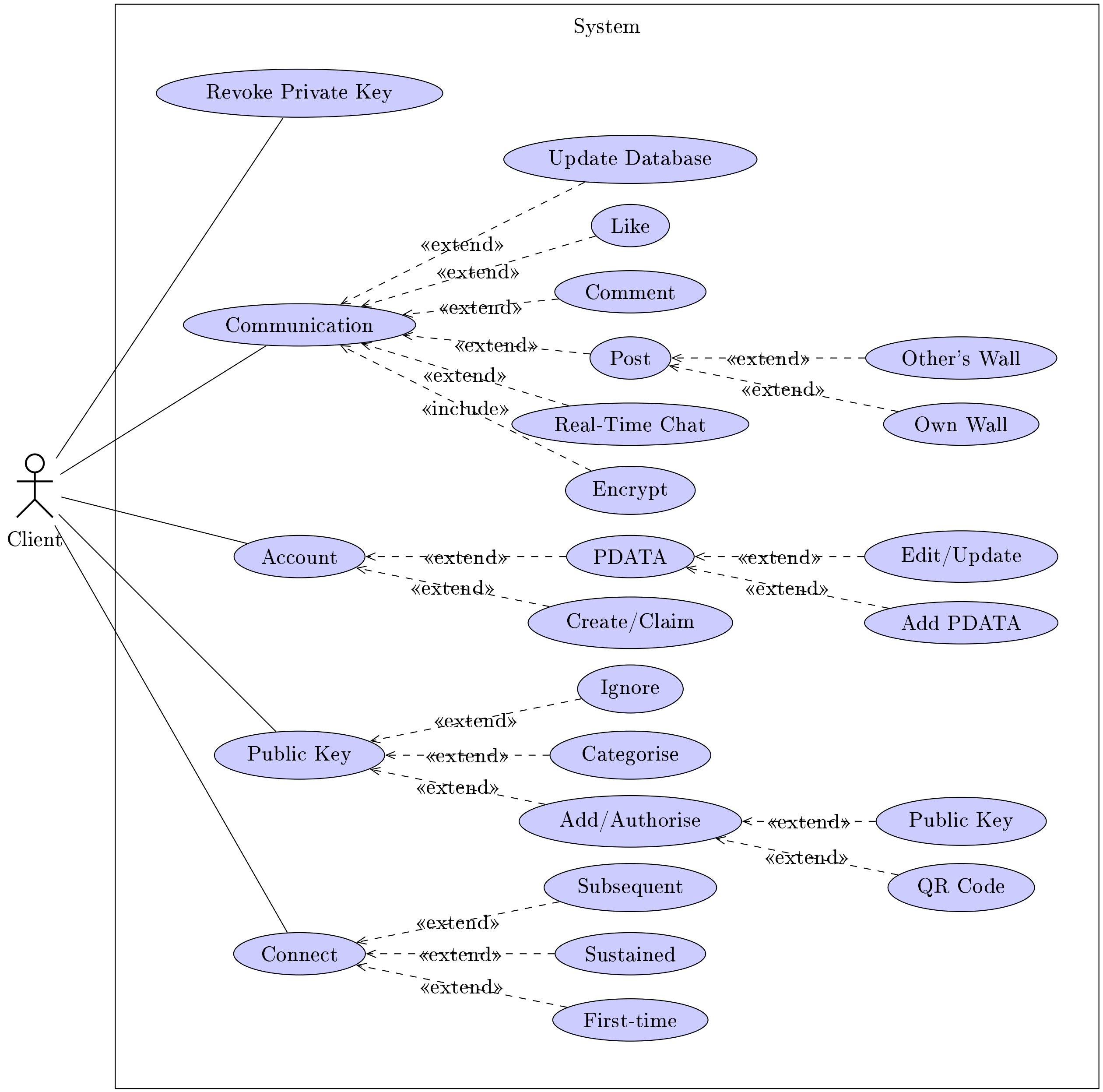
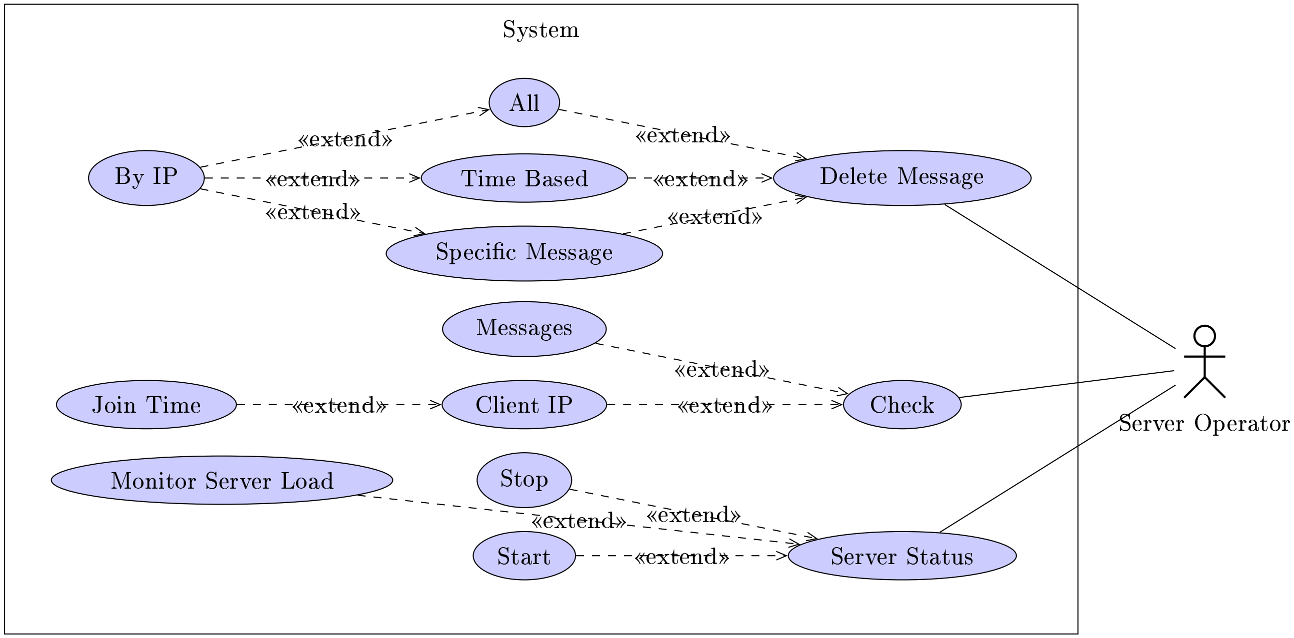


Figure 3.1: Data Flow Diagram

Chapter 4

Use Case Diagrams


System
Revoke Private Key
Update Database
Like
Comment
Communication
Post
Other's Wall
Own Wall
Real-Time Chat
Encrypt
«extend»
«include»
Client
Account
PDATA
Edit/Update
Add PDATA
Create/Claim
Ignore
Public Key
Categorise
Add/Authorise
Public Key
QR Code
Subsequent
Connect
Sustained
First-time


System
All
By IP
Time Based
Delete Message
Specific Message
Messages
Join Time
Client IP
Check
Monitor Server Load
Stop
Start
Server Status
Server Operator
«extend»

Chapter 5

Protocol

5.1 High Level Summary of Protocol

pretty dataflow diagra

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.

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.

5.2 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 5.1: 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 $<unix\_time\_in\_ms>\_<SHA256\_hash>$.

5.3 Client-Client Protocol

5.4 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

5.5 Message Formatting

5.5.1 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:

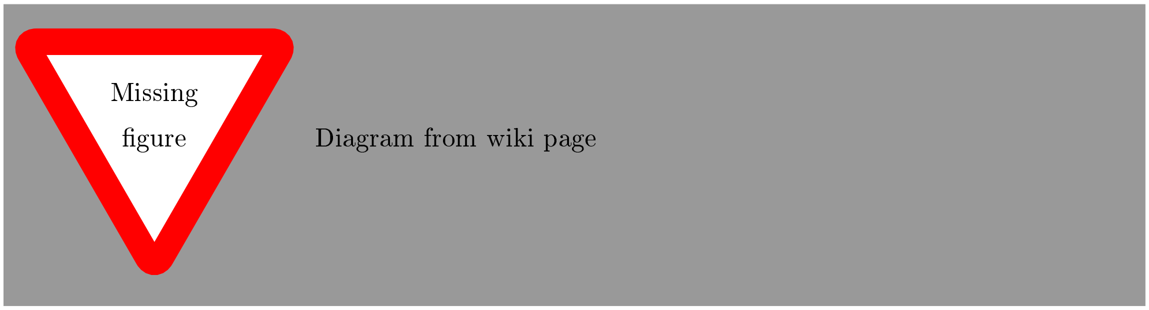
$$<command>\backslash<signature>\backslash<content>\backslash<timestamp>$$

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

An example follows:

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

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.



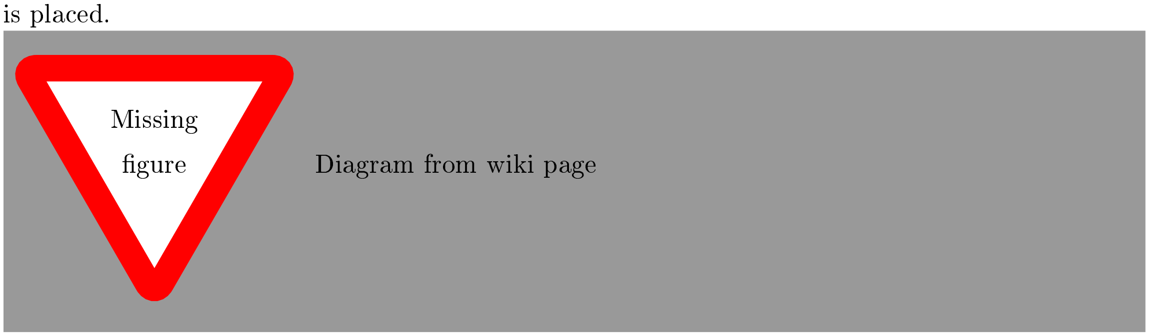
5.5.2 Encrypted Messages

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:

$$<\mathit{AES\ IV}>\backslash<\mathit{RSA\ encrypted\ random\ AES\ key}>\backslash<\mathit{AES\ encrypted\ message}>$$

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



5.6 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:

$$\mathrm{CLAIM}\backslash<signature>\backslash<username>\backslash<timestamp>$$

5.7 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:

$$\mathrm{REVOKE}\backslash<signature>\backslash<time>\backslash<timestamp>$$

5.8 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:

$$\mathrm{PDATA}\backslash<signature>\backslash<values>\backslash<timestamp>$$

The format for values follows:

$$<field>: <value>; \ldots$$

An example follows:

$$\mathrm{PDATA}\backslash<signature>\backslash\text{name:Luke Thomas;dob:1994;}\backslash<timestamp>$$

5.9 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:

$$\mathrm{CHAT}\backslash<signature>\backslash<keys>\backslash<timestamp>$$

The format for keys follows:

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

An example follows:

$$\mathrm{CHAT}\backslash<signature>\backslash<key1>:<key2>\backslash<timestamp>$$

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

PCHAT\<*signature*>\<*conversation*>:<*message*>\<*timestamp*>

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

PCHAT\<*signature*>\9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08:First!\<*timestamp*>

5.10 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\<*signature*>\<*message*>\<*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\<*signature*>\Hello, World!
foo\\bar\\baz\<*timestamp*>

5.11 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\<*signature*>\Hello, World!\<*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).

5.12 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:

CMNT\<*signature*>\<*hash*>: <*comment*>\<*timestamp*>

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

CMNT\<*signature*>\v/sXfb3DG2qT2k2hXIH4csJy1yEG+TANRbbxQw1VkSE=: Yeah, well, that's just like, your opinion, man.\<*timestamp*>

5.13 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:

LIKE\<*signature*>\v/sXfb3DG2qT2k2hXIH4csJy1yEG+TANRbbxQw1VkSE=\<*timestamp*>

5.14 Events

A user may have the client remind him of an event by alerting him when it occurs. A user may inform others of events, and they may choose to be reminded about them. When a user creates an event just for themselves they just create a normal event and only inform themselves of it. An event is created by posting an EVNT message to the server. The format follows:

EVNT\<*signature*>\<*event_start_time*>: <*event_end_time*>: <*event_name*>\<*timestamp*>

An example follows of a reminder for bobs birthday which occurs on the 14th of january, the event was created on the second of january:

EVNT\<*signature*>\1389657600000: 1389744000000: bobs birthday\1388676821000

Chapter 6

Class Interfaces

6.1 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.

concile return types
stated public classes

ify what's static

return	function	description
void	main()	(static) starts the server

Table 6.1: Server

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

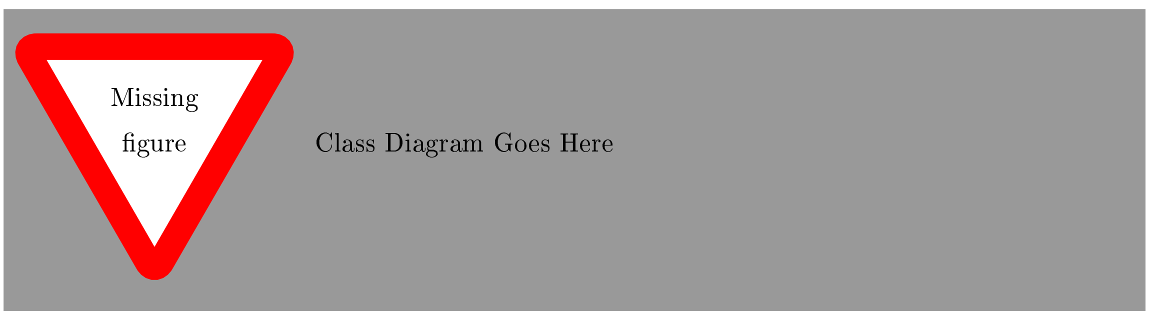
Table 6.2: Client

ver DB interface with
guys and aishiah

return	function	description
N/A	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
void	event()	create an event
void	revoke()	revoke your keypair

Table 6.3: NetworkConnection

6.2 Class Diagram



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

Table 6.4: Crypto

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

Table 6.5: Parser

return	function	description
void	addClaim()	adds a username CLAIM message
pair<string,string>[]	getClaims()	gets all CLAIMs to usernames
string[]	getUsernames()	gets all usernames
void	addRevocation()	adds a keypair revocation
pair<PublicKey, long>[]	getRevocations()	gets all revocations
boolean	isRevoked()	returns the time a key was revoked, if the given key has not been revokes then 0 is returned.
void	addPData()	adds (or amends existing) profile data
string	getPData()	gets the specified piece of profile data for a specified user
void	createChat()	creates new chat
pair<string,string>[]	getChat()	returns messages from a given chat
void	addToChat()	adds a post to a given chat
void	addPost()	creates new post, on your or anothers wall
pair<string,string>[]	getPosts()	gets all posts either within timeframe, or from certain people within a timeframe
void	addComment()	adds a comment onto post or comment
pair<string,string>[]	getComments()	gets all comments for a post or comment
void	addLike()	likes a post or comment
String[]	getLikes()	gets all likes from certain person within a timeframe
int	countLikes()	gets the number of likes for a comment or post
void	addEvent()	adds new event
pair<string,long>[]	getEvent()	gets all events within timeframe
void	acceptEvent()	accepts notification of an event
void	declineEvent()	declines notification of an event
void	addKey()	adds a public key to the DB
PublicKey[]	getKey()	gets the public key for a usernamne, or all which are stored)
string	getName()	gets a username for the given public key
void	addFriend()	adds the given friend to the DB
void	addCategory()	adds a new category to the DB
void	addToCategory()	adds a user to a category

Table 6.6: Database

return	function	description
N/A	GUI()	Constructs a GUI
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 6.7: GUI

return	function	description
N/A	Message()	Consturcts a message with given data
Message	parse()	(static) 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 6.8: Message

return	function	description
N/A	Pair()	Consturcts a pair with given data
A	first()	returns the first value passed to the constructor
B	second()	returns the second value passed to the constructor

Table 6.9: Pair<A, B>

Chapter 7

Pseudocode

7.1 Server

```
static void main () {
    startGUIthread()
    startServer()
}

static void start () {
    socket = new ServerSocket(port)
    while (running) {
        incoming = socket.accept()
        t = new Thread(new Session(incoming))
        t.start()
    }

    shutdown()
}
```

7.2 Client

```
static void main () {
    NetworkConnection connection    = new NetworkConnection("server.tld")
    Thread            networkThread = new Thread(connection)
    Database          db            = new Database("./db")
```

```
    GUI              gui          = new GUI(db, connection)
    Thread           guiThread    = new Thread(gui)

    if (!Crypto.keysExist())
        Crypto.keyGen()

    networkThread.start()
    guiThread.start()

    while (gui.isRunning())
        while (connection.hasMessage())
            Parser.parse(Crypto.decrypt(connection.getMessage()), db)
}
```

7.3 Crypto

```
keyGen () {
    keypair = generateRSAkeypair()
    pw      = GUI.getUserInputString()
    filesystem.write("keypair", Crypto.aes(pw, keypair))
}

static String sign (String msg) {
    byte[] sig = SHA1RSAsign(msg.getBytes("UTF-8"), Crypto.getPrivateKey())
    return Crypto.Base64Encode(sig)
}

static String encrypt(String cmd, String text, PublicKey recipient,
                      NetworkConnection connection) {
    Message msg = new Message(cmd, text, connection.getTime()+Crypto.rand(0,50),
                              Crypto.sign(text))

    //encrypt with random AES key with random initalization vectors
    byte[]     iv = new byte[16]
    byte[] aeskey = new byte[16]

    fillWithRandomData(iv);
    fillWithRandomData(aeskey);
```

```
    byte[] aesCipherText = aes(aeskey, iv, msg.toString().getBytes("UTF-8"))

    //encrypt AES key with RSA
    byte[] encryptedAESKey = rsa(Crypto.getPrivateKey(), aeskey)

    //"iv\RSA encrypted AES key\ciper text"
    return Base64Encode(iv) + "\\" + Base64Encode(encryptedAESKey) +
           "\\" + Base64Encode(aesCipherText)
}

static Message decrypt(String msg) {
    //handle claim messages (which are the only plaintext in the system)
    if (msg.substring(0,2).equals("c "))
        return Message.parse(Base64Decode(msg.substring(2)))

    //handle encrypted messages
    String[] tokens = new String[3]
    tokens = tokenize("msg", "\")

    byte[] iv            = Base64Decode(tokens[0])
    byte[] cipheredKey   = Base64Decode(tokens[1])
    byte[] cipherText    = Base64Decode(tokens[2])

    //decrypt AES key
    byte[] aesKey = rsaDecrypt(cipheredKey, getPrivateKey())

    //decrypt AES Ciphertext
    aes.init(Cipher.DECRYPT_MODE, aesKeySpec, IVSpec)
    byte[] messagePlaintext = aesDecrypt(cipherText, aesKey, iv)

    return Message.parse(messagePlaintext)
}
```

7.4 Database

Most database functions are just going to construct parameterized SQL queries to be sent to the database from passed parameter values. The exceptions which include significant computing are listed here:

```
void addKey (PublicKey k) {
    for each row r in table message_claim
        if (Crypto.verifySig(r.signature, k))
            addFriend(new Friend(k, r.username))
}

PublicKey[] getKey (String username) {
    PublicKey[] keys
    for each row r in table user
        if (r.username == username)
            keys.add(r.public_key)
    return keys
}

void addToCategory (Friend f, String category) {
    for each row r in table wall_post
        if (r.permission_to includes category)
            sendMessage(r, f)
}
```

7.5 Network Connection

The vasy majority of messages here merely construct the appropriate message from the parameters and pass it to serverCmd()

```
void main (String _url) {
    url = _url
    messages    = new Vector<String>()
    messageLock = new Semaphore(1)
    connected   = true

    File lastReadFile = new File("./db/lastread")
    lastRead = Long.parseLong(lastReadFile.readLine())
}

void run () {
    while(running) {
```

```
        sleep(delay)
        downloadNewMessages()
    }
}

String[] serverCmd(String cmd) {
    Socket s;
    BufferedReader in;
    PrintWriter out;


    //connect
    s = new Socket(new Proxy(Proxy.Type.SOCKS, new InetSocketAddress("localhost", 9050)))
    s.connect(new InetSocketAddress(url, port))
    in  = new BufferedReader(new InputStreamReader(s.getInputStream()))
    out = new PrintWriter(s.getOutputStream(), true)

    //send command
    out.println(cmd);
    out.flush();

    //recieve output of server
    Vector<String> output = new Vector<String>();
    String line = null;
    do {
        line = in.readLine();
        if (line != null)
            output.add(line);
    } while (line != null);
}
```

7.6 Parser

```
void parse (String msg, Database db) {
    Message m = Message.parse(msg)
    if (m.cmd == "PDATA") {
        String[] tokens = tokenize(msg.content, ":")
```

```
        db.addPData(tokens[0], tokens[1])
    } else if (m.cmd == "REVOKE") {
        PublicKey key
        for row r in table users
            if Crypto.verifySig(r.public_key, m.signature)
                key = r.public_key
        db.addRevocation(key)
    } else if {
        etc...
}
```

Chapter 8

Database

Merge w/transaction details

8.1 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.

8.1.1 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.

8.1.2 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.

8.1.3 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.

8.1.4 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.

8.1.5 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.

8.1.6 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.

8.1.7 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.

8.2 Table layout of the database

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

Table 8.1: user

Name	Datatype	Key
user_id	VARCHAR(50)	PK
username	VARCHAR(25)	
name	VARCHAR(30)	
birthday	DATE	
sex	VARCHAR(1)	
email	VARCHAR(30)	
public_key	VARCHAR(8)	PK

Table 8.2: is_in_category

Name	Datatype	Key
is_in_id	INT(10)	PK
category_id	INT(10)	FK
user_id	INT(50)	FK

Table 8.3: category

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

Table 8.4: private_message

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

Table 8.5: is_in_message

Name	Datatype	Key
is_in_id	VARCHAR(50)	PK
time	DATETIME	
message_id	VARCHAR(50)	
user_id	VARCHAR(8)	

Table 8.6: 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	DATETIME	

Table 8.7: has_comment

Name	Datatype	Key
comment_id	INT(100)	PK
post_id	INT(100)	FK
user_id	VARCHAR(50)	FK
comment_comment_id	INT(100)	
time	DATETIME	

Table 8.8: has_like

Name	Datatype	Key
like_id	INT(100)	PK
post_id	INT(100)	FK
user_id	INT(100)	FK
comment_id	INT(100)	FK
time	DATETIME	

Table 8.9: events

Name	Datatype	Key
event_id	INT(100)	PK
title	VARCHAR(10)	
content	VARCHAR(40)	
time_created	DATETIME	
start_date	DATETIME	
end_date	DATETIME	
from	INT(100)	FK
invite	INT(100)	FK
decision_id	INT(100)	

Table 8.10: event_decision

Name	Datatype	Key
decision_id	INT(100)	PK
decision	VARCHAR(6)	

Table 8.11: login_logout_log

Name	Datatype	Key
log_id	INT(10)	PK
login_time	DATETIME	
logout_time	DATETIME	

Table 8.12: key_revoke

Name	Datatype	Key
revoke_id	INT(100)	PK
signature	VARCHAR(?)	
time	DATETIME	

Table 8.13: message_claim

Name	Datatype	Key
username	VARCHAR(25)	PK
signature	VARCHAR(?)	

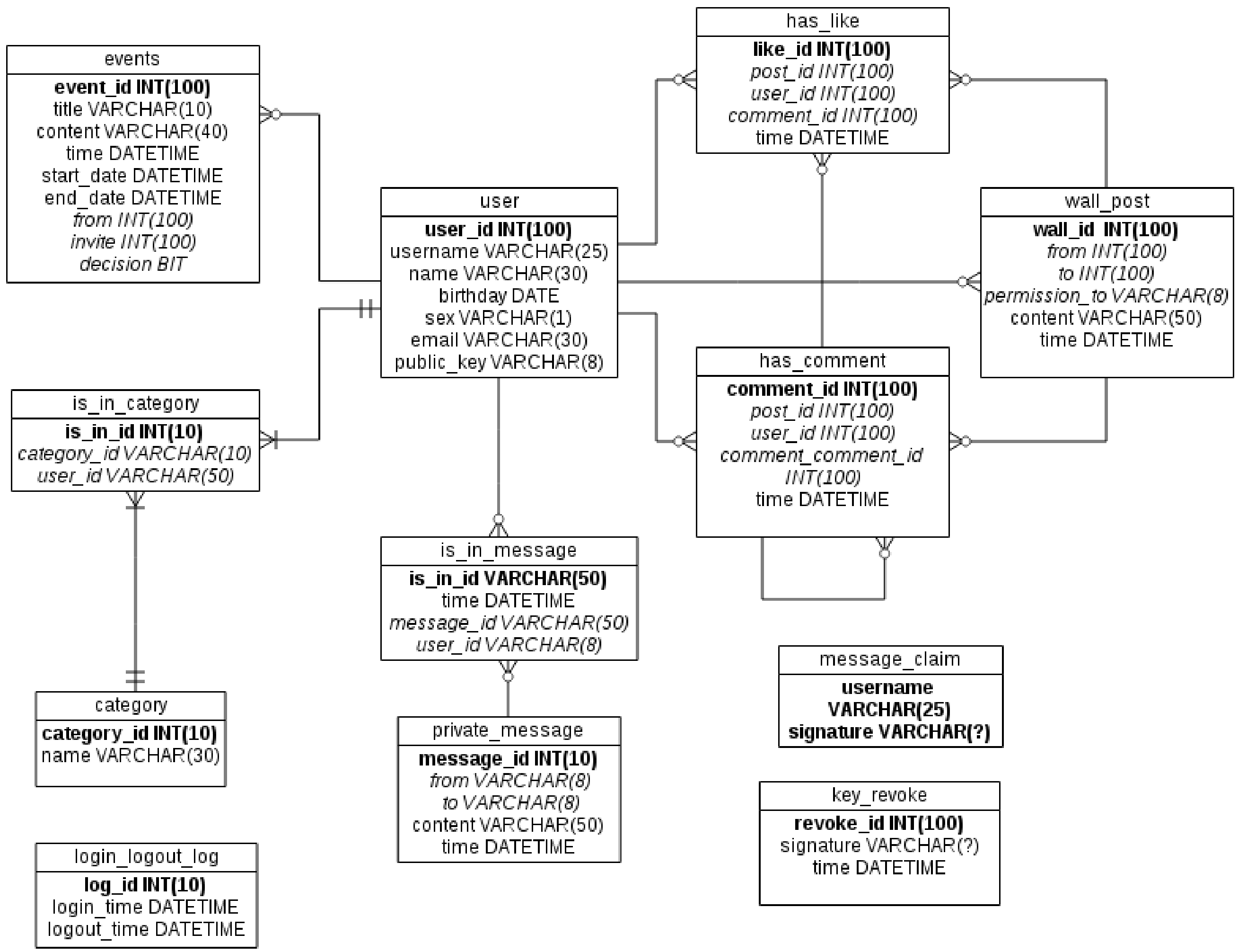


Figure 8.1: Database Entity Relationship diagram

Chapter 9

Transaction details

The table below shows the transaction details of each function which will be found in the program. There are four types of transactions for databases which are insert, read, update and delete.

Insertion is done when new data is added into a NULL attribute. Read on the other hand, is to view information from selected table(s) and its attribute(s). Similar as insertion but update is conducted when data already exists in the particular attribute. This basically removes previous data and add a new one. Lastly, delete, as it is self explanatory, deletes the whole tuple from the database. However this is usually avoided in database norms.

Function	**Table(s) involved**	**Transaction(s)**
addClaim()		
getClaims		
getUsernames	user	Read
addRevocation	key_revoke	Insert
getRevocations	key_revoke	Read
isRevoked()	key_revoke	Insert
addPData()		
getPData()		
createChat()	private_message	Insert
getChat()	private_message, is_in_message	Read
addToChat()	is_in_message	Insert
addPost()	wall_post	Insert
getPosts()	wall_post	Read

Function	**Table(s) involved**	**Transaction(s)**
addComment()	has_comment	Insert
getComments()	has_comment	Read
addLike()	has_like	Insert
getLikes()	has_like	Read
countLikes()	has_like	Read and count
addEvent()	events	Insert
getEvent()	events	Read
acceptEvent()	events	Update
declineEvent()	events	Update
addKey()		
getKey()		
getName()	user	Read
addFriend()		
addCategory()	category	Insert
addToCategory()	is_in_category	Insert

Chapter 10

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.

10.1 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 nineties." - 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.

10.2 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, making any GUI displayed via it look rather dated. None of the the current team has any proficiency with AWT however, and whilst it is possible to learn, there are still other options to consider that may provide the use with a more professional GUI build.

10.3 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.

10.4 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.

10.5 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 11

Business Rules

In standard projects the business model can commonly outline certain validation practices for the program or project in the form of business rules or policies. Our project, and its fundamental idea, works a little different than most projects in terms of business, as per such we have only one business rule.

To ensure the client never sends identifying data to the server or its operators.

This is to ensure that the privacy of communcation is always within the hands of the client and user, as opposed to any who run the network. To violate this single rule would be going against both the company ideals, and the projects goals.

Chapter 12

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.

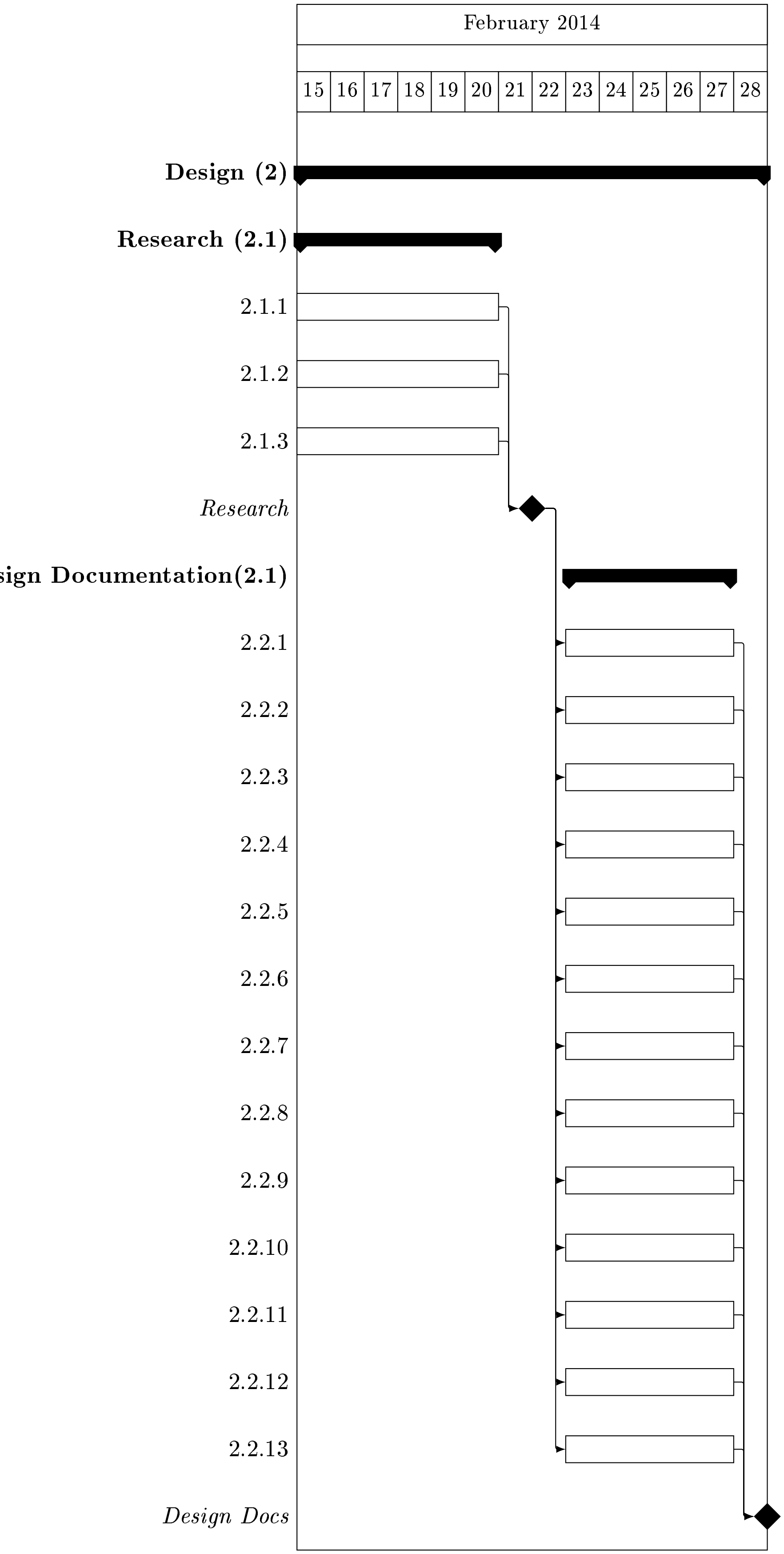
The website's create function: http://goqr.me/api/doc/create-qr-code/ The website's read function: http://goqr.me/api/doc/read-qr-code/ A test one I did: https://api.qrserver.com/v1/create-qr-code/?size=300x300&data=%3Ci'mThePublicKeyVariable%3E&format=svg

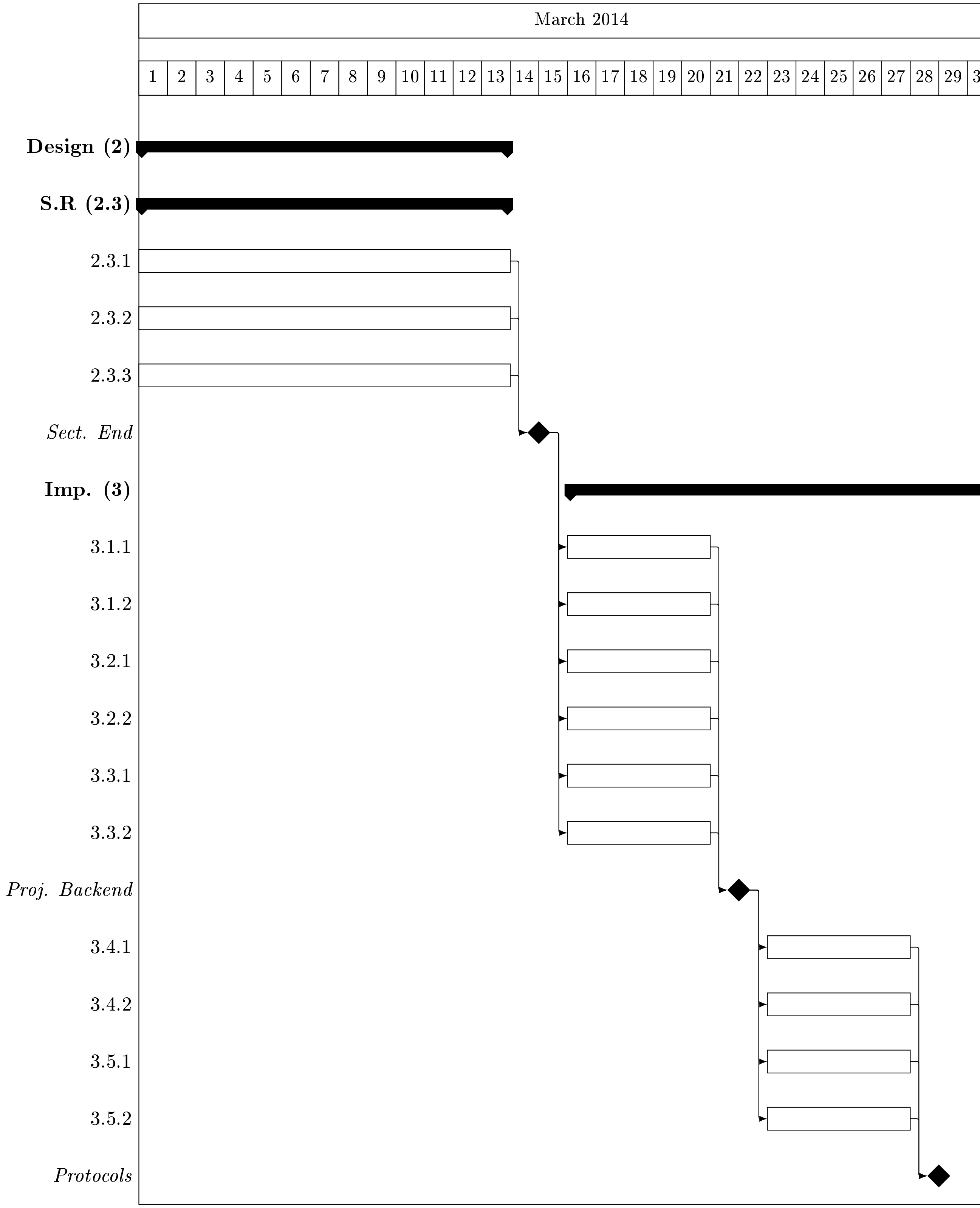
Chapter 13

Gantt Chart

These are excerpts from the Gantt charts made during the requirements stage of the project. They have been used as a guide throughout the completed sections of the project. As the design section was foreseen as the most work-intensive part that is encompassed within the project, particular care and attention was made to make sure that official deadlines were met, through the use of un-official end dates for each task.

By doing so, therefore finishing tasks earlier than required, it has provided a buffer used for quality controlling the project's deliverables.


February 2014
15 16 17 18 19 20 21 22 23 24 25 26 27 28
Design (2)
Research (2.1)
2.1.1
2.1.2
2.1.3
Research
sign Documentation(2.1)
2.2.1
2.2.2
2.2.3
2.2.4
2.2.5
2.2.6
2.2.7
2.2.8
2.2.9
2.2.10
2.2.11
2.2.12
2.2.13
Design Docs


March 2014
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Design (2)
S.R (2.3)
2.3.1
2.3.2
2.3.3
Sect. End
Imp. (3)
3.1.1
3.1.2
3.2.1
3.2.2
3.3.1
3.3.2
Proj. Backend
3.4.1
3.4.2
3.5.1
3.5.2
Protocols

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

Licence

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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

into legality of distri-
on

into legality of distri-
on

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)

- **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)
- **INCOMPLETE** Transaction Design (Aishah) (what values each transaction modifies)

- **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