



# CipherChat

A Secure, Decentralized Chat Application

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# Motivation

In today's world the internet has become a hotbed of hacking plots at data harvesting. CipherChat was created based on the premise that everyone should be entitled to their privacy regardless of how ignorant that individual may be.

# Tools Used

The following languages contributed to completion of this project

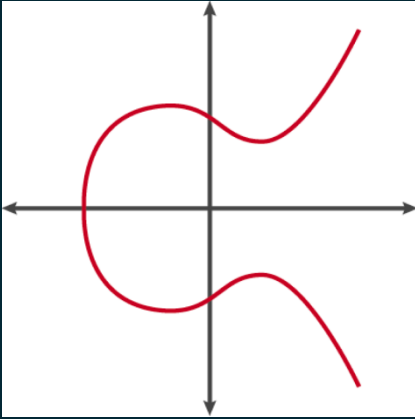
1. JavaScript (Server & Client)
2. Dart (Client)
3. SQL (Server & Client)
4. Bash Scripting Language (Server)

# Cryptography

CipherChat is Made Secure through the implementation of the following cryptographic technologies:

- Hypertext Transfer Protocol Secure
- Elliptic Curve Diffie Hellman Key Exchange Protocol
- Elliptic Curve Digital Signature Algorithm
- Advanced Encryption Standard (256 bit)

# Chosen Elliptic Curve



SECP256k1

Used by government agencies and many cryptocurrencies due to special properties

# Elliptic Curve Diffie Hellman

Bob



Bob picks private key  $\beta$

$$1 \leq \beta \leq n-1$$

Computes

$$B = \beta G \% p$$

Receives

$$A = (x_A, y_A)$$

Computes

$$P = \beta \alpha G \% p$$

Eve



$$y^2 = x^3 + ax + b$$

$p$

$a$

$b$

$G$

$n$

$h$

$A$

$B$

$$P = ?$$

Alice



Alice picks private key  $\alpha$

$$1 \leq \alpha \leq n-1$$

Computes

$$A = \alpha G \% p$$

Receives

$$B = (x_B, y_B)$$

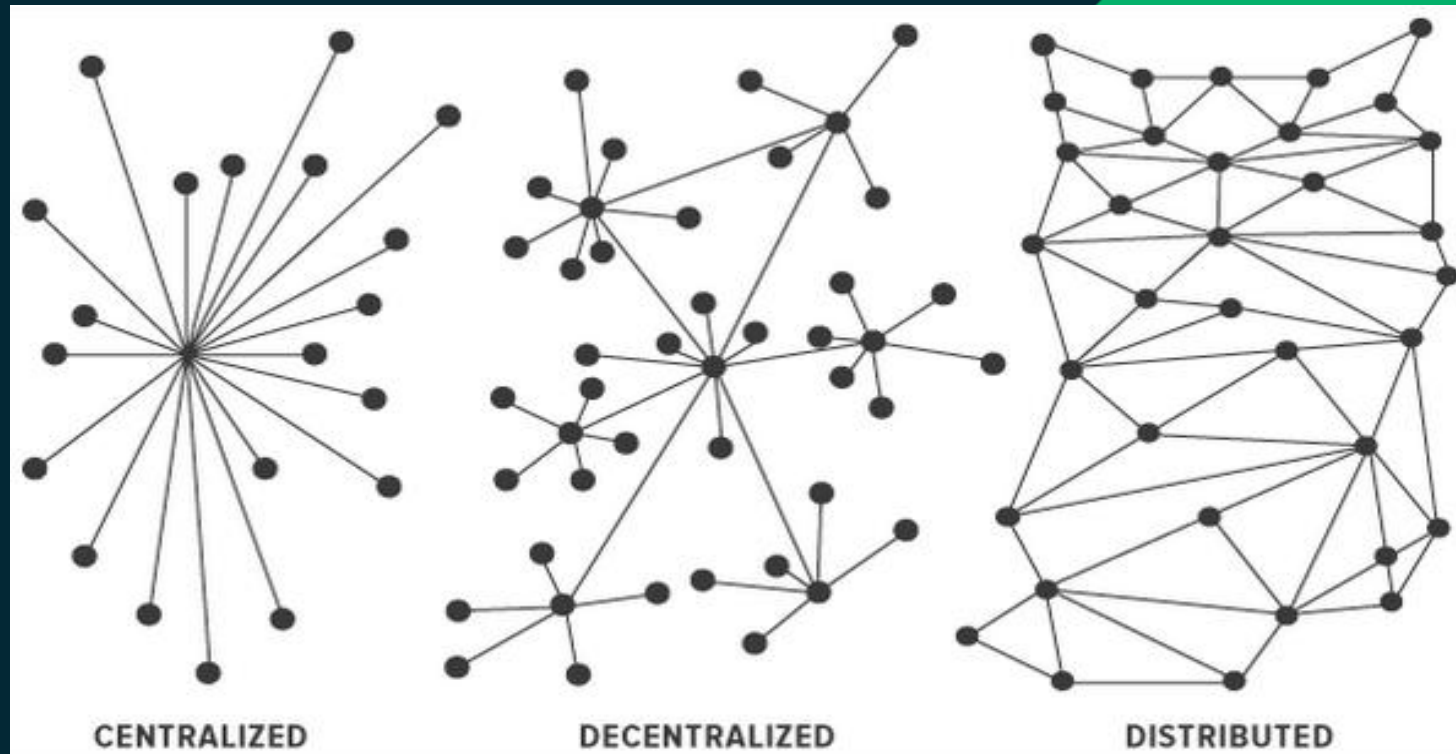
Computes

$$P = \alpha \beta G \% p$$

# Method

1. Multiple clients connect to a CipherChat server
2. Clients exchange public keys using ECDH
3. Messages are encrypted using the generated symmetric key and AES
4. Messages are signed using ECDSA Signing
5. The encrypted message is sent to the server
6. The server verifies the authenticity of the message using the signature (ECDSA Verification)
7. Server saves the authenticated message
8. The other peer(s) sends requests to the server and receive the latest messages
9. The received messages are decrypted using the symmetric key and AES

# Why Decentralization?



Decentralization creates a system which naturally more reliable and allows average individuals to benefit, rather than a single entity.



# Load Balanced Servers

```
const handler = function(req, res){  
  req.pipe(request({ url: servers[currentServer] + req.url })).pipe(res);  
  currentServer = (currentServer + 1) % servers.length;  
};
```

```
otto@ottor-HP-Notebook:~/Apps/Mobile-Application-Tech-Year-3-Semester-2/SWEN3004/SERVER$ ./status.sh  
info:    Forever processes running  
data:    uid  command  script          forever pid   id  logfile          uptime  
data:    [0] UGtU  ./node  loadBalancer.js 11285  11294  /home/otto/.forever/UGtU.log 0:0:0:14.618  
data:    [1] gGik  ./node  server.js       11312  11340  /home/otto/.forever/gGik.log 0:0:0:11.547  
data:    [2] cP-w  ./node  server.js       11351  11372  /home/otto/.forever/cP-w.log 0:0:0:10.868  
data:    [3] pSha  ./node  server.js       11383  11396  /home/otto/.forever/pSha.log 0:0:0:10.128
```

CipherChat Servers are designed to be scalable. Multiple instances can be ran simultaneously on separate threads with each instance handling tasks asynchronously, maximizing efficiency

# Open Source

## Food for Thought

1. Why should anyone trust applications if they cannot prove for themselves that it is secure?
2. Applications should be secure by design and not by policy!

CipherChat is completely Open Source and is secure by design. In other words it is virtually hackproof

<https://github.com/CipherChat/CipherChat/>



Live Demonstration

# Future Improvements

1. Use of websockets instead of polling
2. Create more incentives for person to host their own CipherChat servers
3. Notifications
4. Make app multilingual
5. Allow for the parsing of more complex data such as images and videos

## Distant Future

1. Facilitate the sending of digital currency (crypto)
2. Blockchain
3. Free Decentralized Applets (Cab Hailing, Package Delivery etc.)



Thank you for your kind attention!