TÉCNICO LISBOA

GrooveGalaxy

Grupo A42

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Points of Discussion

- Secure Document Format implementation
- Built infrastructure
- Secured channels
- Key distribution
- Security challenge implementation
- Main results and conclusions

Secure Document Format Implementation

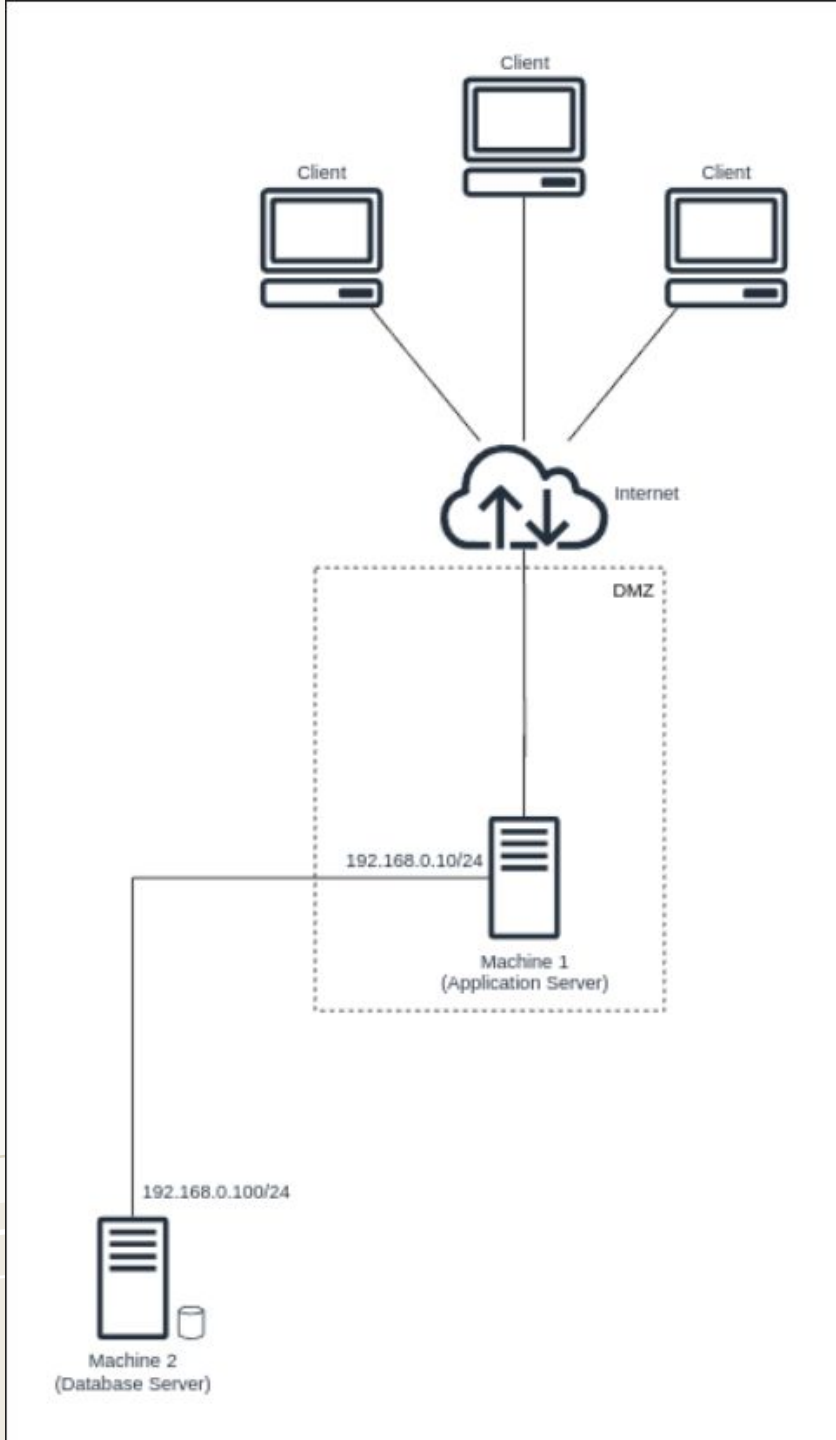
- Only the audio (field “audioBase64”) is encrypted.
  - The encryption algorithm used was AES with CTR block encryption and zero padding.
  - The encryption is made using a temporary key sent encrypted by a permanent key to the client.
- The document is sent as whole in “bytes” format.
- The digital signature used to authenticate the server is made from the content plus the IV used to encrypt plus the encrypted temporary key, also the one used to encrypt.
  - The secure hash algorithm used was SHA-256.
- For freshness we use a nonce, composed of a random number and a timestamp.

This ensures confidentiality of the audio and authenticity of the document.


```
{
  "media": {
    "mediaInfo": {
      "owner": "Bob",
      "format": "WAV",
      "artist": "Alison Chains",
      "title": "Man in the Bin",
      "genre": ["Grunge", "Alternative Metal"]
    },
    "mediaContent": {
      "lyrics": [
        "Trapped in a world, a box of my own",
        "Container whispers, in this space alone",
        "Echoes of silence, in the walls I confide",
        "A man in the box, with nowhere to hide",
        "Chained by thoughts, in a silent uproar",
        "Searching for keys, to unlock the door"
      ],
      "audioBase64": "UklGRiQIAAAWQVZAAWQVZFZm10IBAAAA
    }
  }
}
```

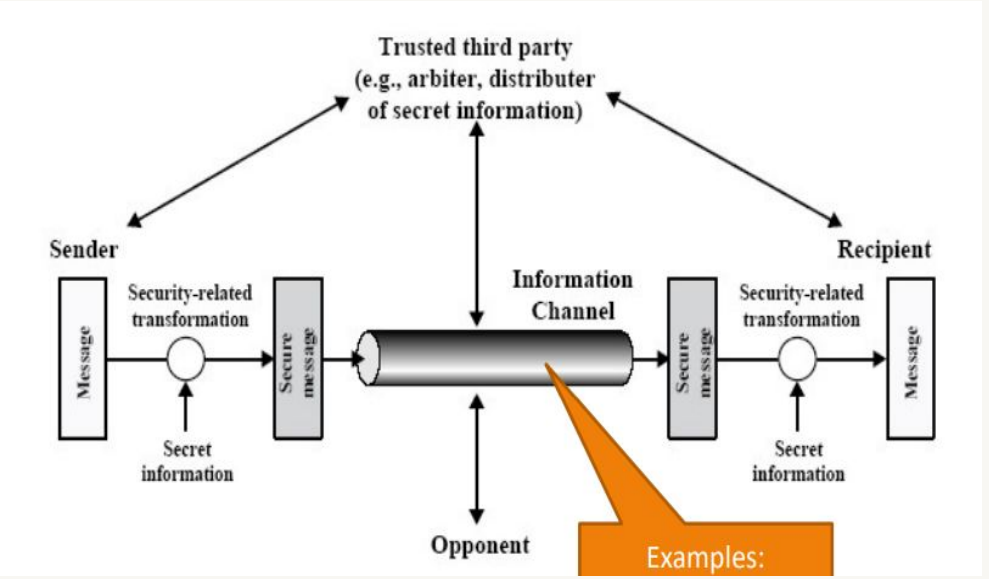
Built Infrastructure

- Database server:
  - Authentication and TLS implemented by MySQL.
  - All the data in the database supposedly encrypted, also using MySQL already provided encryption.
- Application server:
  - Deals with business logic and communicates with the clients and database server
- Clients:
  - Connect to the application server through the internet.
  - Cannot be trusted



Secured Channels

- Both the channels between the clients and the application server and this last and the database implement TLS/SSL.
  - This allows for encryption of the transmitted content.
  - Also provides authentication
    - The clients and the application server authenticate themselves to each other.
    - The database and the application server do this as well.

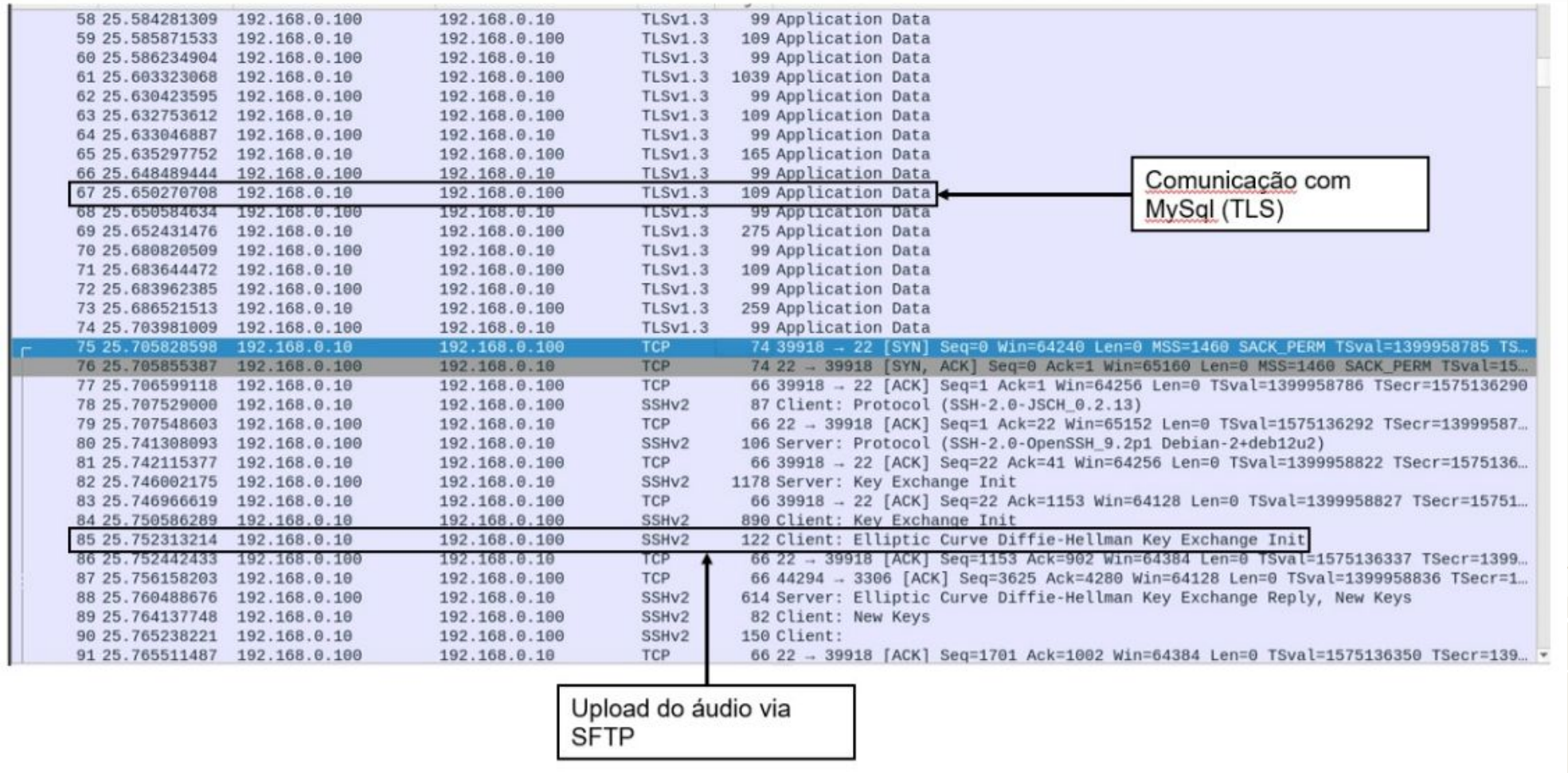


Secured Communication Between Client and Application Server

No.	Time	Source	Destination	Protocol	Length	Info
537	272.307821388	192.168.1.50	192.168.1.10	TLSv1.2	132	Application Data
538	272.313097805	192.168.1.10	192.168.1.50	TLSv1.2	105	Application Data
539	272.314504799	192.168.1.50	192.168.1.10	TLSv1.2	105	Application Data
540	272.356241196	192.168.1.10	192.168.1.50	TCP	66	5001 → 43310 [ACK] Seq=40 Ack=106 Win=505 Len=0 TSval=2159875745 TSecr=27957372…
542	272.516731435	192.168.1.10	192.168.1.50	TLSv1.2	101	Application Data
543	272.519507393	192.168.1.10	192.168.1.50	TLSv1.2	120	Application Data
544	272.519945237	192.168.1.50	192.168.1.10	TCP	66	43310 → 5001 [ACK] Seq=106 Ack=129 Win=501 Len=0 TSval=2795737499 TSecr=2159875…
545	272.521198406	192.168.1.50	192.168.1.10	TLSv1.2	105	Application Data
546	272.523871731	192.168.1.10	192.168.1.50	TCP	66	5001 → 43310 [ACK] Seq=129 Ack=145 Win=505 Len=0 TSval=2159875911 TSecr=2795737…
547	272.523872074	192.168.1.10	192.168.1.50	TLSv1.2	98	Application Data
548	272.525769083	192.168.1.10	192.168.1.50	TLSv1.2	105	Application Data
549	272.526779898	192.168.1.50	192.168.1.10	TCP	66	43310 → 5001 [ACK] Seq=145 Ack=200 Win=501 Len=0 TSval=2795737506 TSecr=2159875…

Exemplo de um pedido do cliente ao servidor (TLS)

Secured Communication Between Application Server and Database



Key Distribution

- The client and the application server share a secret (symmetric) key from the beginning.
  - This symmetric key is permanent (stored securely in java keystores).
  - It is used to encrypt a **temporary key** (stored in the database).
- The document is encrypted using a symmetric temporary key
  - The temporary keys are renewed all at the same time by the database server.
- The client also has the application server public key (not in a keystore) from the get go to verify the digital signature of received documents.
- The server has its own private key (not in a keystore) to sign digital signatures.

Certificate Distribution

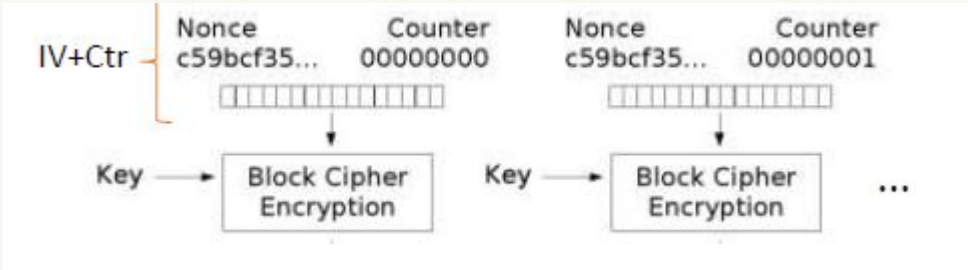
- The clients and application server posses two java keystores.
  - One containing the certificate of application server, allowing it to authenticate itself towards the clients.
  - Another containing client certificates (each client only has its own) so that the clients can authenticate themselves towards the application server.

This combination allows for the clients and application server to ensure that they are talking to each other and not a malicious attacker.

- The database already has a certificate, made available by MySQL.

Security Challenge Implementation

- In order to allow for playback of a music from the middle of it we used **Counter** mode for our symmetric block encryption keys.
- To implement the concept of family sharing, we made it so that the temporary keys (used to encrypt the documents) would be a family key, also temporary, shared by all the users of a family.
  - This change is invisible to the clients.



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Main Results and Conclusions

- We were able to secure the documents and the communication channels.
- Unfortunately, our clients do not store the song documents in a confidential way.
- We also did not setup the firewalls in the application server and the database, which would have improved security