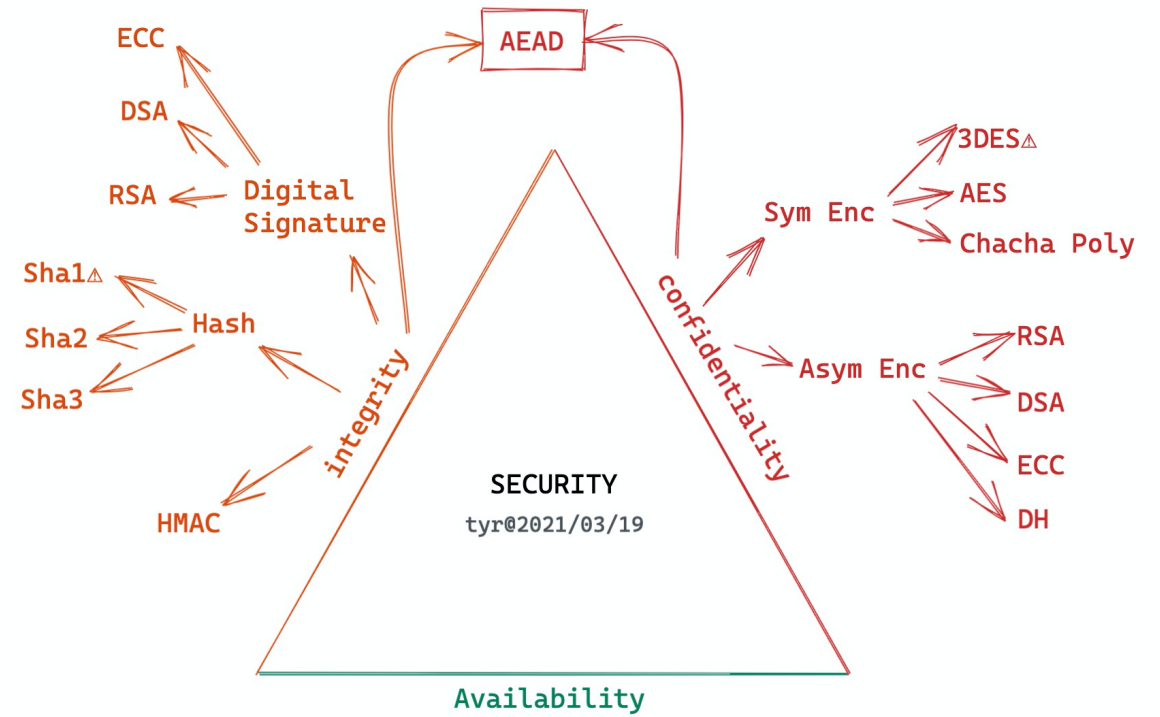
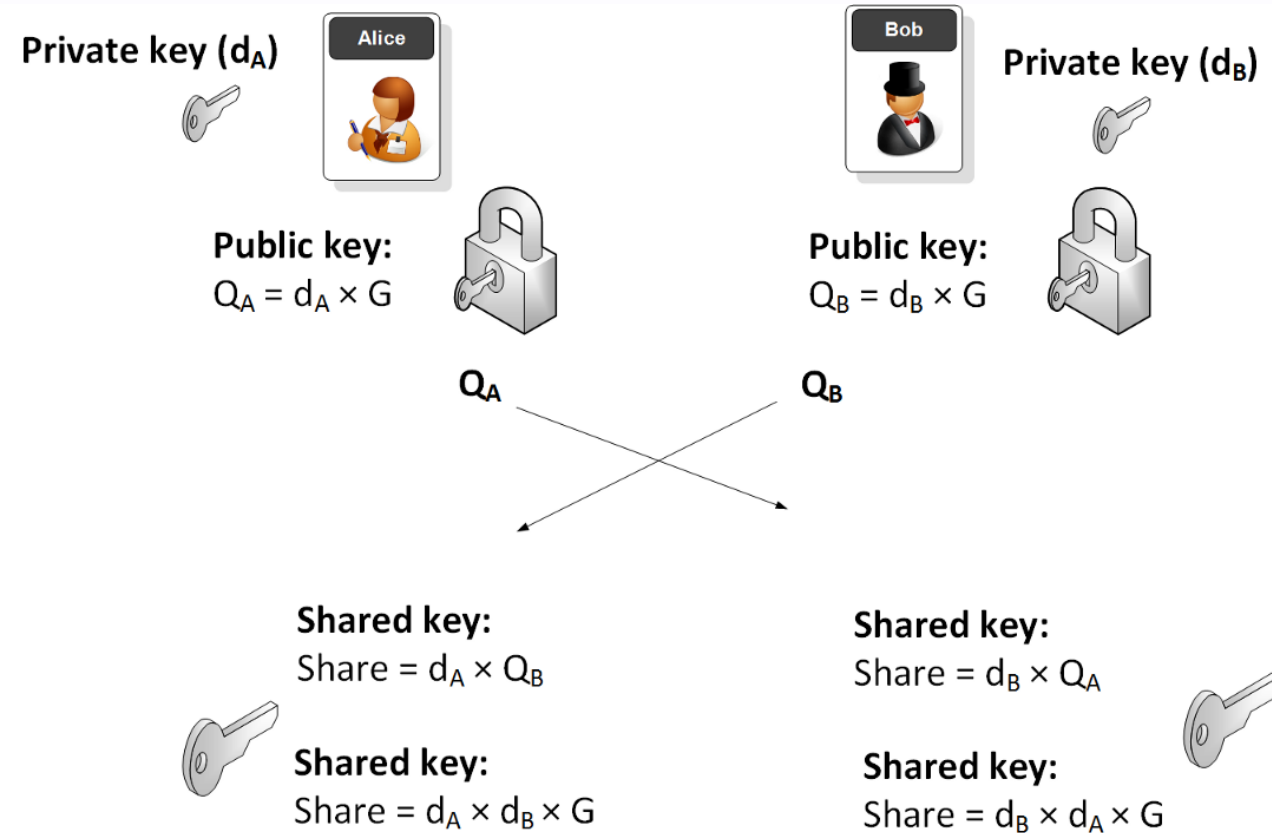


Rust: 





- 〇〇〇〇〇〇〇〇〇 - TLSv1.3
- 〇〇〇〇〇〇〇〇〇〇〇〇 - Noise Protocol
- 〇〇〇〇〇〇〇〇〇〇 DH 〇〇



Rust TLS ☐☐

- openssl
- rustls (☐☐ ring)
- tokio-tls-helper



- 创建domain的CA cert
- 创建cert / key

```
# client configuration
```

```
domain = "localhost"
```

```
[cert]
```

```
pem = """-----BEGIN CERTIFICATE-----
MIIBeTCCASugAwIBAgIBKjAFBgMrZXAwNzELMAkGA1UEBgcwVVMx
FDASBgNVBAoMC0RvbWVpbiBJbmMuMRIwEAYDVQQDDA1Eb21haW4g
Q0EwHhcNMjEwMzE0MTg0NTU2WjA3MQswCQYDVQQGDAJVUzEUMBI
GA1UECgwLRG9tYWluIEluYy4xEjAQBgNVBAMMURvbWVpbiBDQTAq
MAUGAytlcAMhAAZhorM9IPsXjBTxZxykGl5xZrsj3X2XqKjaAVutnf
7po1wwWjAUBgNVHREEDTALgglb2NhbGhvc3QwHQYDVR00BBYEFD
+NqChBZD0s5FMgefHJSIWIRTHXMBIGA1UdEwEB/wQIMAYBAf8CAR
AwDwYDVR0PAQH/BAUDAwcGADAFBgMrZXADQQA9sIlgQcYGAqTxR1
+JadSelMKWp35+yhVVuu4PTL18kwdU819w3cVlRe/GHt+jjlbk1i
22Tv05AaNdmdxySk0-----END CERTIFICATE-----"""
```

```
# server configuration
```

```
[identity]
```

```
key = """-----BEGIN PRIVATE KEY-----
MFMCQAQEWBQYDK2VwBCIEII0kozD0PjsbnfNUS/oqI/Q/enDiLwmdw
+JUnTLpR9xs0SMDIQAtkhJiFdF9SYBIMcLikWPRigca/Rz9ngIgd6Hu
G6HI3g==-----END PRIVATE KEY-----"""
```

```
[identity.cert]
```

```
pem = """-----BEGIN CERTIFICATE-----
MIIBazCCAR2gAwIBAgIBKjAFBgMrZXAwNzELMAkGA1UEBgcwVVMx
FDASBgNVBAoMC0RvbWVpbiBJbmMuMRIwEAYDVQQDDA1Eb21haW4g
Q0EwHhcNMjEwMzE0MTg0NTU2WjA3MQswCQYDVQQGDAJVUzEUMBI
GA1UECgwLRG9tYWluIEluYy4xFDASBgNVBAMMURvbWVpbiBDQTAq
MAUGAytlcAMhAAZhorM9IPsXjBTxZxykGl5xZrsj3X2XqKjaAVutnf
7po1wwWjAUBgNVHREEDTALgglb2NhbGhvc3QwHQYDVR00BBYEFD
+NqChBZD0s5FMgefHJSIWIRTHXMBIGA1UdEwEB/wQIMAYBAf8CAR
AwDwYDVR0PAQH/BAUDAwcGADAFBgMrZXADQQA9sIlgQcYGAqTxR1
+JadSelMKWp35+yhVVuu4PTL18kwdU819w3cVlRe/GHt+jjlbk1i
22Tv05AaNdmdxySk0-----END CERTIFICATE-----"""
```



- - `ServerTlsConfig`
 - `TLS acceptor`
 - `acceptor.accept(tcp_stream)`
- - `ClientTlsConfig`
 - `TLS connector`
 - `connector.connect(tcp_stream)`

```
Server:

```rust
// you could also build your config with cert and identity separately. See tests.
let config: ServerTlsConfig = toml::from_str(config_file).unwrap();
let acceptor = config.tls_acceptor().unwrap();
let listener = TcpListener::bind(addr).await.unwrap();
tokio::spawn(async move {
 loop {
 let (stream, peer_addr) = listener.accept().await.unwrap();
 let stream = acceptor.accept(stream).await.unwrap();
 info!("server: Accepted client conn with TLS");

 let fut = async move {
 let (mut reader, mut writer) = split(stream);
 let n = copy(&mut reader, &mut writer).await?;
 writer.flush().await?;
 debug!("Echo: {} - {}", peer_addr, n);
 };

 tokio::spawn(async move {
 if let Err(err) = fut.await {
 error!("{:?}", err);
 }
 });
 }
});
```
```

```
Client:

```rust
let msg = b"Hello world\n";
let mut buf = [0; 12];

// you could also build your config with cert and identity separately. See tests.
let config: ClientTlsConfig = toml::from_str(config_file).unwrap();
let connector = config.tls_connector(Uri::from_static("localhost")).unwrap();

let stream = TcpStream::connect(addr).await.unwrap();
let mut stream = connector.connect(stream).await.unwrap();
info!("client: TLS conn established");

stream.write_all(msg).await.unwrap();

info!("client: send data");

let (mut reader, _writer) = split(stream);

reader.read_exact(buf).await.unwrap();

info!("client: read echoed data");
```
```

Noise Protocol

- TLS vs Noise protocol 对比 vs 对比
- Noise_IKpsk2_25519_ChaChaPoly_BLAKE2s
 - I 标识符
 - K 密钥
 - psk2 预共享密钥 Pre-Shared-Key 支持 2 种模式
 - ChaChaPoly 加密算法
 - BLAKE2s 哈希算法
- 支持 0-RTT (x 指 xpsk 模式)

Noise Protocol

- build HandshakeState
- write(msg, buf): buffer
- read(buf, msg) buffer buffer
- into_transport_mode HandshakeState CipherState
- rekey rekey

□ O-RTT □

- Initiator:

- □□ HandshakeState
- □□□□□□
- □□□□□□

- Responder:

- □□ HandshakeState
- □□□□□□
- □□□□□□

```
pub fn new(config: SessionConfig) -> Result<Self, ConcealError> {
    let mut header: Header = config.header;
    let noise_params: NoiseParams = header.to_string().parse()?;
    // in handshake mode this should be enough
    let mut buf: [u8; _] = [0u8; 256];

    if header.handshake_message.is_empty() {
        // initiator
        let mut noise: HandshakeState = if !header.use_psk {
            Builder::new(noise_params): Builder
                .remote_public_key(pub_key: &config.rs.unwrap()): Builder
                .local_private_key(&config.keypair.private): Builder
                .build_initiator()?
        } else {
            Builder::new(noise_params): Builder
                .remote_public_key(pub_key: &config.rs.unwrap()): Builder
                .local_private_key(&config.keypair.private): Builder
                .psk(location: 1, key: &config.psk.unwrap()): Builder
                .build_initiator()?
        };

        let len: usize = noise.write_message(payload: &[0u8; 0], message: buf.as_mut());
        let handshake_message: Vec<u8> = buf[..len].to_vec();
        header.handshake_message = handshake_message;
        let state: TransportState = noise.into_transport_mode()?;
        Ok(Self { state, header })
    } else {
        // responder
        let mut noise: HandshakeState = if !header.use_psk {
            Builder::new(noise_params): Builder
                .local_private_key(&config.keypair.private): Builder
                .build_responder()?
        } else {
            Builder::new(noise_params): Builder
                .local_private_key(&config.keypair.private): Builder
                .psk(location: 1, key: &config.psk.unwrap()): Builder
                .build_responder()?
        };

        let _len: usize = noise.read_message(&header.handshake_message, payload: &mut buf)?;
        let state: TransportState = noise.into_transport_mode()?;
        Ok(Self { state, header })
    }
}
```

□□ □□ □□□□ □□□

□□ / □□ / □□□

Cellar

- Bitcoin HD wallet (BIP-32 Hierarchical Deterministic Wallets)
- (User Passphrase)
- (Application Key)

```
salt          = Secure-Random(output_length=32)
stretched_key = Argon2(passphrase=user_passphrase, salt=salt)

auth_key      = HMAC-BLAKE2s(key=stretched_key, "Auth Key")
c1            = HMAC-BLAKE2s(key=stretched_key, "Master Key")
c2            = Secure-Random(output_length=32)
encrypted_c2  = ChaCha20(c2, key=auth_key, nonce=salt[0..CHACHA20_NONCE_LENGTH])

master_key    = HMAC-BLAKE2s(key=c1, c2)
application_key = HMAC-BLAKE2s(key=master_key, "app info, e.g. yourname@gmail.com")
```

Cellar

- 实现 Ed25519
- 支持 x509

```
#[test]
Debug
fn generate_key_by_path_should_work() -> Result<(), CellarError> {
    let passphrase: &str = "hello";
    let aux: AuxiliaryData = init(passphrase)?;
    let key: Zeroizing<u8; _> = generate_master_key(passphrase, &aux)?;
    let parent_key: Vec<u8> = generate_app_key(passphrase, &aux, info: b"apps", KeyType::Password)?;
    let app_key: Vec<u8> = generate_app_key_by_path(parent_key: key, path: "apps/my/awesome/key", KeyType::Password)?;
    let app_key1: Vec<u8> = generate_app_key_by_path(
        parent_key: as_parent_key(app_key: &parent_key),
        path: "my/awesome/key",
        KeyType::Password,
    )?;
    assert_eq!(app_key, app_key1);
    Ok(())
}

► Run Test | Debug
#[test]
Debug
fn generate_ca_cert_should_work() -> Result<(), CellarError> {
    let info: CertInfo = CertInfo::new(domains: &["localhost"], ips: &[], country: "US", org: "Domain Inc.", cn: "Domain CA", days: None);
    let (_, parent_key: Vec<u8>, cert_pem: CertificatePem) = generate_ca(info.clone());

    load_ca(&cert_pem.cert, key: &cert_pem.sk)?;

    let cert1: Vec<u8> = generate_app_key_by_path(
        parent_key: as_parent_key(app_key: &parent_key),
        path: "localhost/ca",
        KeyType::CA(info),
    )?;

    let cert_pem1: CertificatePem = bincode::deserialize(bytes: &cert1)?;

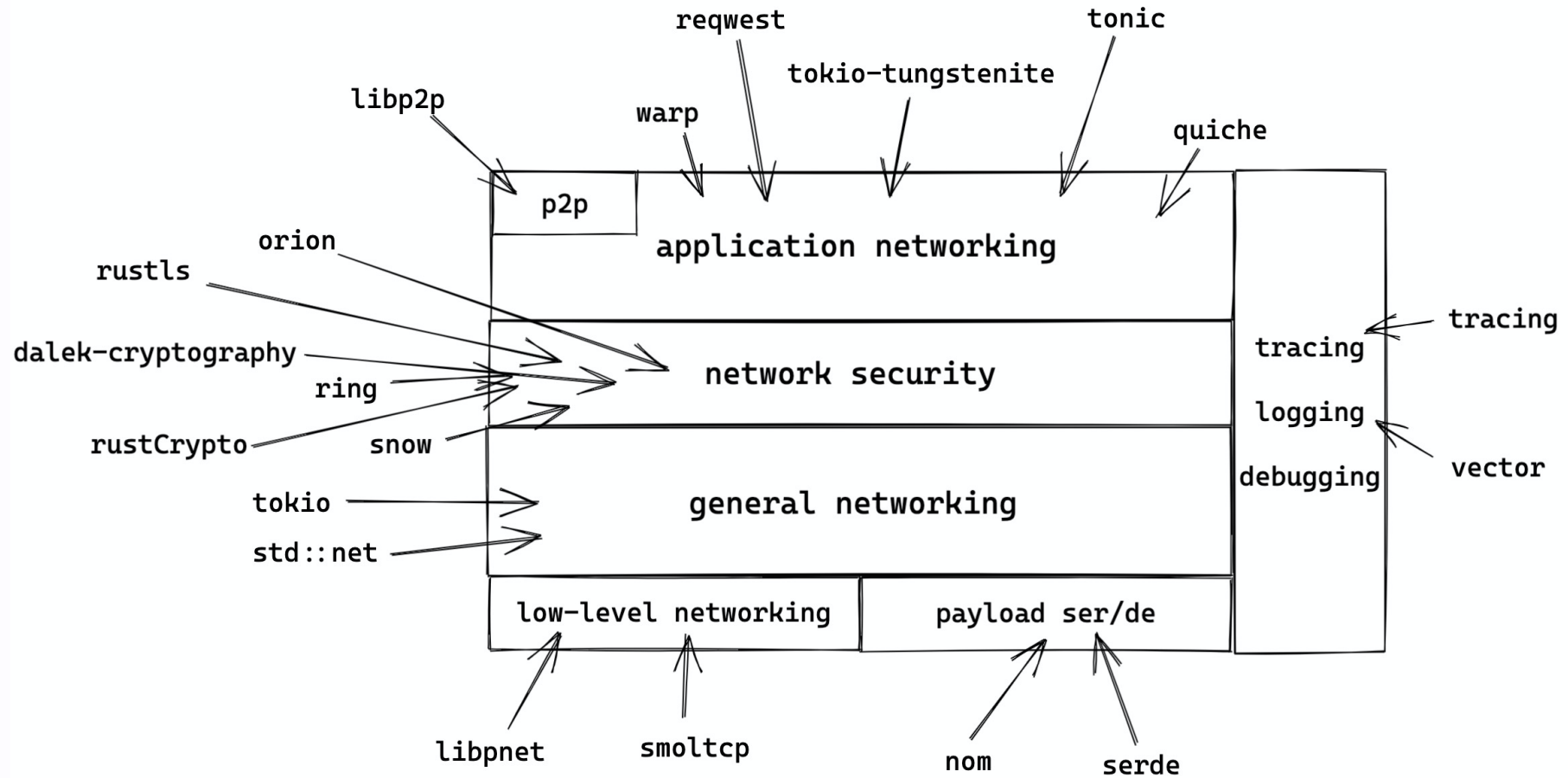
    assert_eq!(&cert_pem.sk, &cert_pem1.sk);
    assert_eq!(&cert_pem.cert, &cert_pem1.cert);

    Ok(())
}

fn generate_ca(info: CertInfo) -> Result<(Key, Vec<u8>, CertificatePem), CellarError> {
    let passphrase: &str = "hello";
    let aux: AuxiliaryData = init(passphrase)?;
    let key: Zeroizing<u8; _> = generate_master_key(passphrase, &aux)?;
    let parent_key: Vec<u8> = generate_app_key(passphrase, &aux, info: b"apps", KeyType::Password)?;

    let cert: Vec<u8> = generate_app_key_by_path(parent_key: key.clone(), path: "apps/localhost/ca", KeyType::CA(info));
    let cert_pem: CertificatePem = bincode::deserialize(bytes: &cert)?;
    Ok((key, parent_key, cert_pem))
}
```

You. seconds ago • Uncommitted changes





- [tokio tls helper](#)
- [Noise](#) [实现](#)
- [Cellar](#): [实现](#)
- [Conceal](#) [实现](#) Noise protocol [实现](#)

May the **Rust** be with you