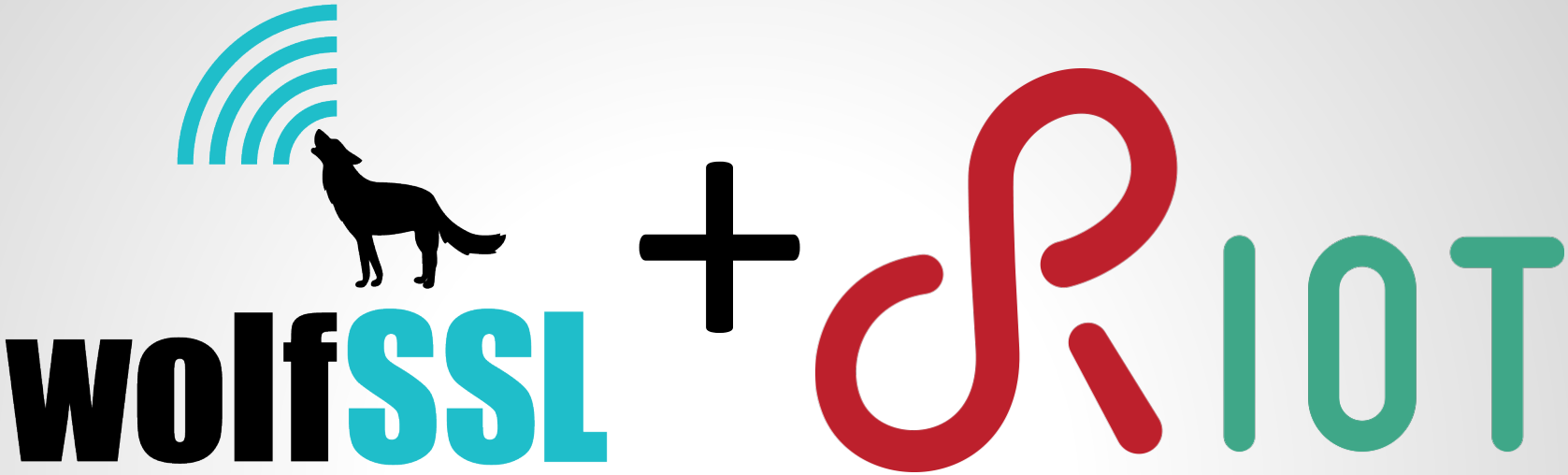


Progressively Securing RIOT-OS!

USABILITY AND NECESSITY OF SSL / TLS

We're going to talk about:

1. **Why** is security important?
2. **What** is SSL?
3. **Where** is SSL being used?
4. **Features**: What to look for in an SSL library?

Why is Security Important?

- Number of connected devices is ever increasing

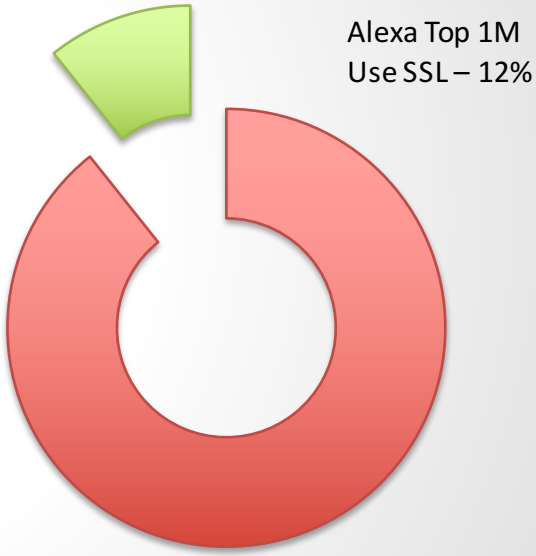
- Frequent Road-blocks:
  - Lack of understanding
  - Insufficient funding
  - Tight deadlines

Why is Security Important?

Ivan Ristic: Internet SSL Survey 2010
http://www.ssllabs.com

- Alexa Top 1M Sites

  120,000 Use SSL (12%)



What is SSL?

X509, Encryption, handshakes, and more.

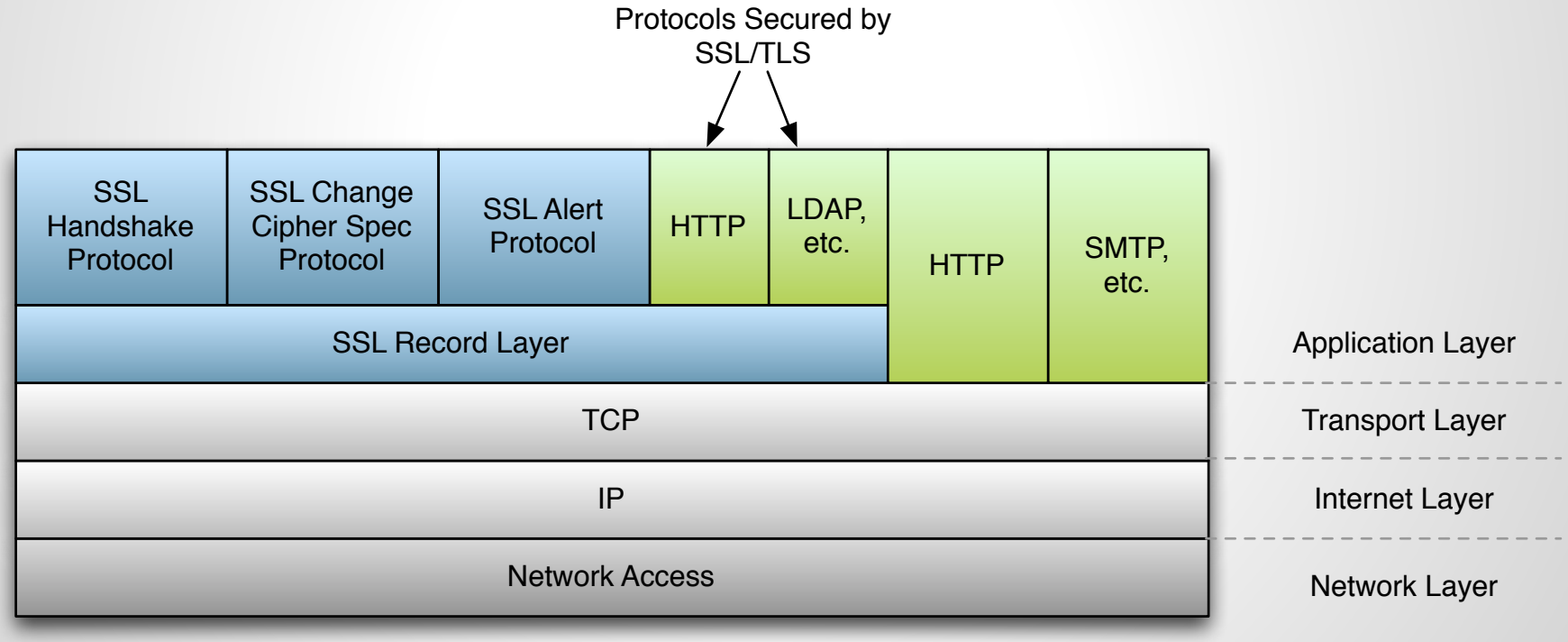
What is SSL?

- Enables secure client / server communication, providing:

Privacy	+ Prevent eavesdropping
Authentication	+ Prevent impersonation
Integrity	+ Prevent modification

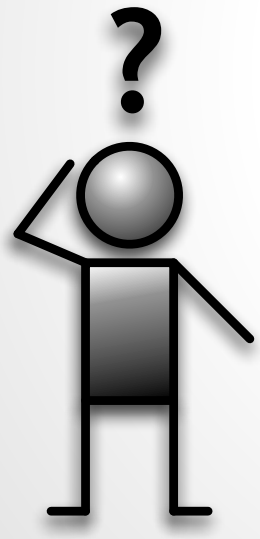
Where does SSL fit?

- Layered between **Transport** and **Application** layers



SSL: Authentication

- Do you really know who you're communicating with?

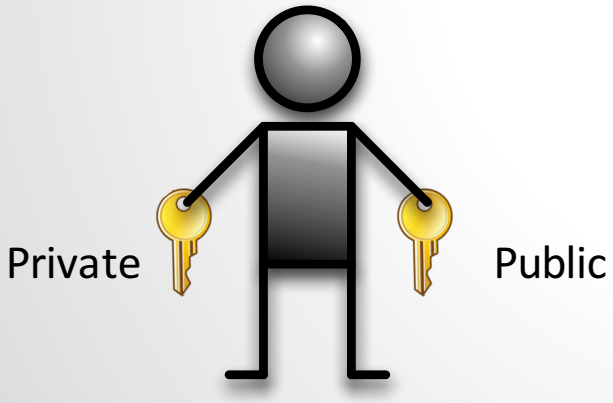


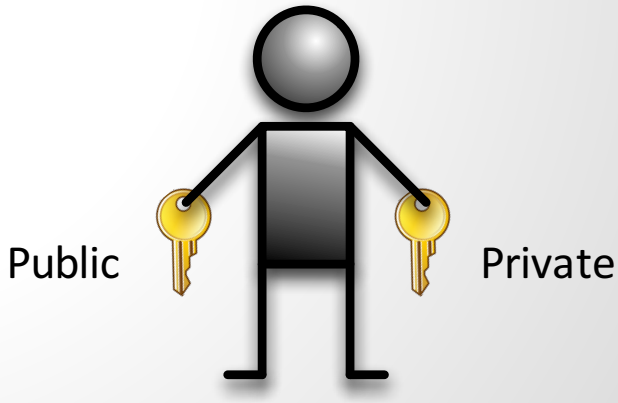
Alice

Bob

SSL: Authentication

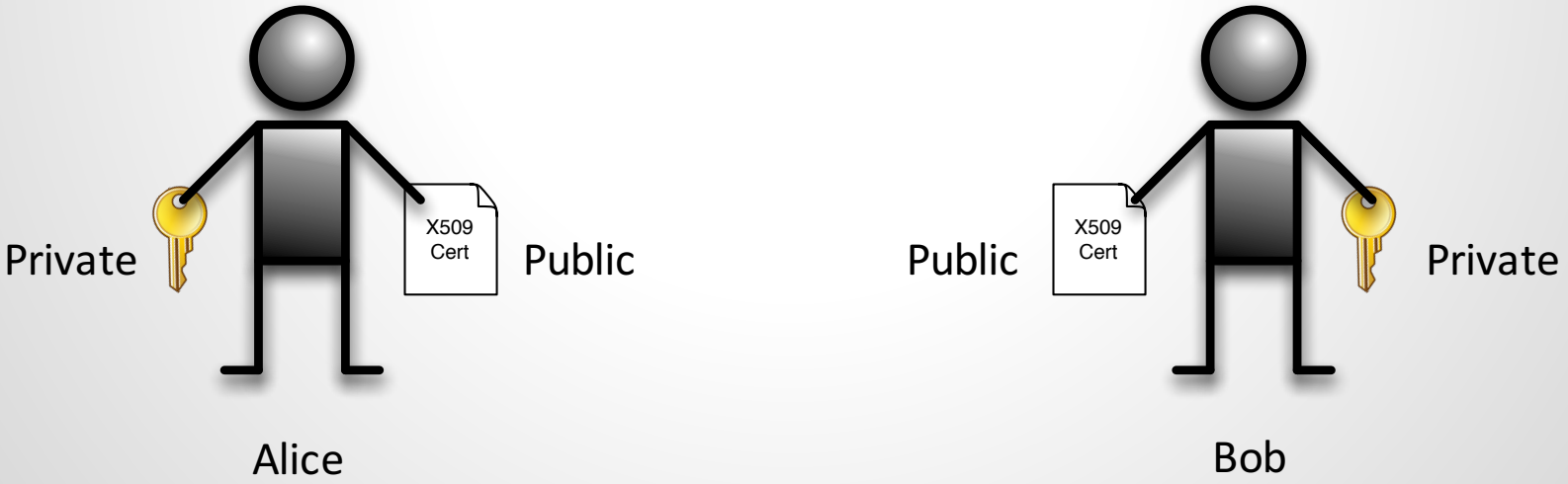
- Generate a key pair (private and public key)



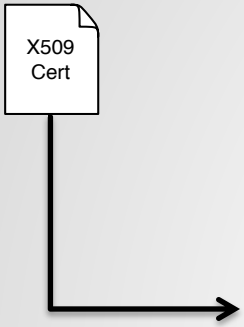


SSL: Authentication

- X.509 Certificate == Wrapper around public key



SSL: X.509 Certificates

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-----END CERTIFICATE-----
```


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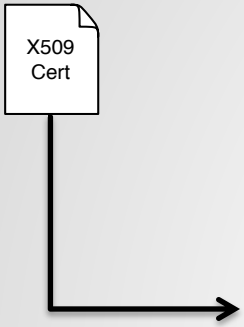
SSL: X.509 Certificates



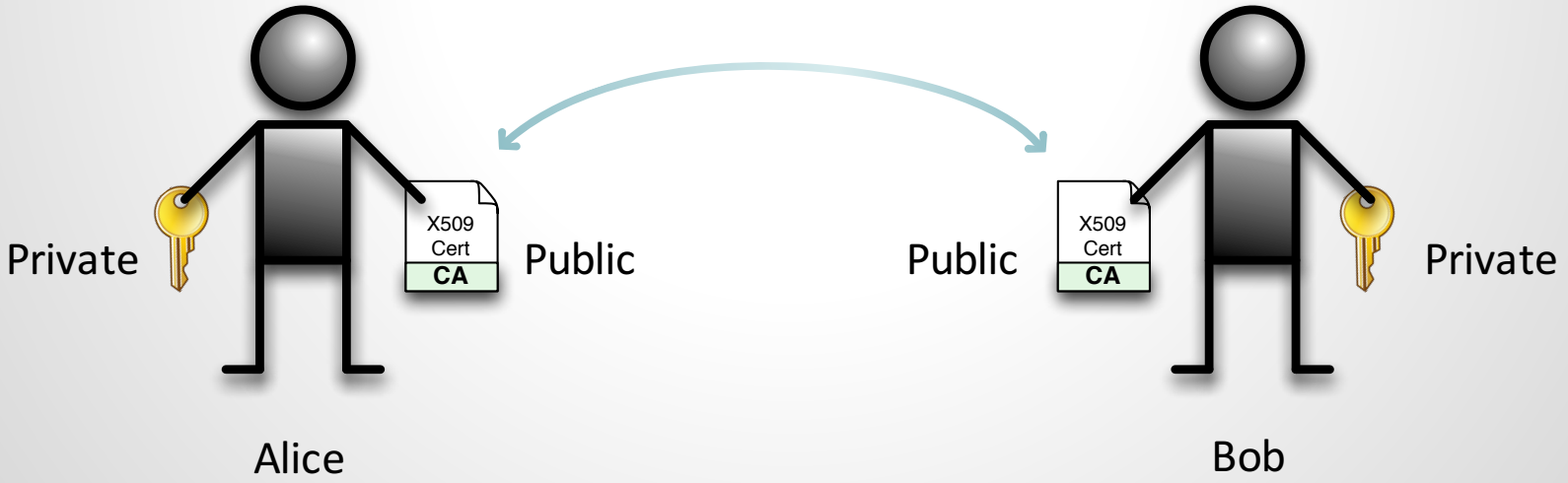

```
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            87:4a:75:be:91:66:d8:3d
        Signature Algorithm: sha1WithRSAEncryption
        Issuer: C=US, ST=Oregon, L=Portland, O=wolfSSL, OU=Programming,
CN=www.wolfssl.com/emailAddress=info@wolfssl.com
        Validity
            Not Before: Oct 24 18:21:55 2011 GMT
            Not After : Jul 20 18:21:55 2014 GMT
        Subject: C=US, ST=Oregon, L=Portland, O=wolfSSL, OU=Programming,
CN=www.wolfssl.com/emailAddress=info@wolfssl.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
                Public-Key: (2048 bit)
                Modulus: 00:c3:03:d1:2b:fe:39:a4 …
                Exponent: 65537 (0x10001)
        X509v3 extensions:
            X509v3 Subject Key Identifier:
                33:D8:45:66:D7:68:87:18:7E:54:0D:70:27:91:C7:26:D7:85:65:C0
            X509v3 Authority Key Identifier:
                keyid:33:D8:45:66:D7:68:87:18:7E:54:0D:70:27:91:C7:26:D7:85:65:C0

DirName:/C=US/ST=Oregon/L=Portland/O=wolfSSL/OU=Programming/CN=www.wolfssl.com/emailAddress=info@w
olfssl.com
                serial:87:4A:75:BE:91:66:D8:3D

            X509v3 Basic Constraints:
                CA:TRUE
    Signature Algorithm: sha1WithRSAEncryption
        … 1c:7c:42:81:29:9e:21:cf:d0:d8
```

SSL: Authentication

- Alice and Bob exchange **CA-signed** public keys



SSL: Authentication

- How do you get a CA-signed cert?

Buy

VeriSign, DigiCert, Comodo, etc.

- Costs $$$
- Trusted

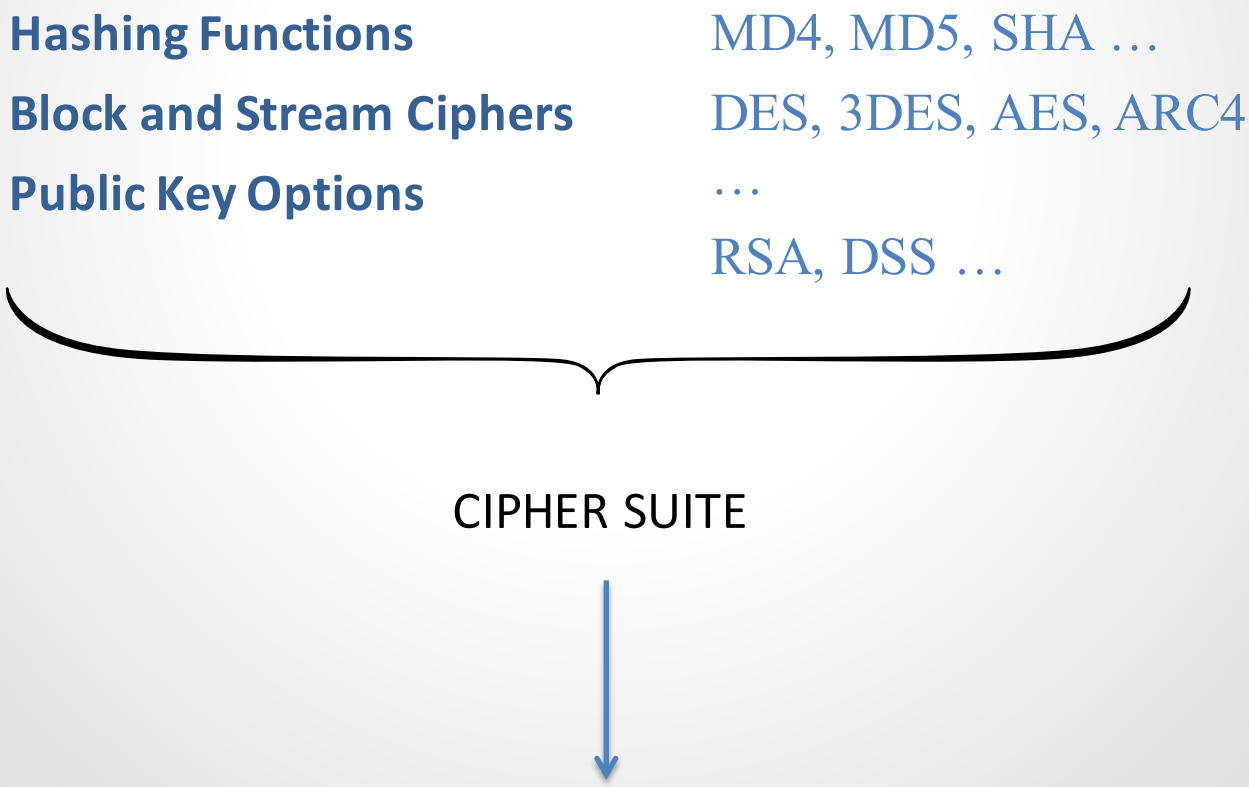
Create

Created yourself (self-sign)

- Free!
- Trusted (if you control both sides)

SSL: Encryption

- Uses a variety of encryption algorithms to secure data



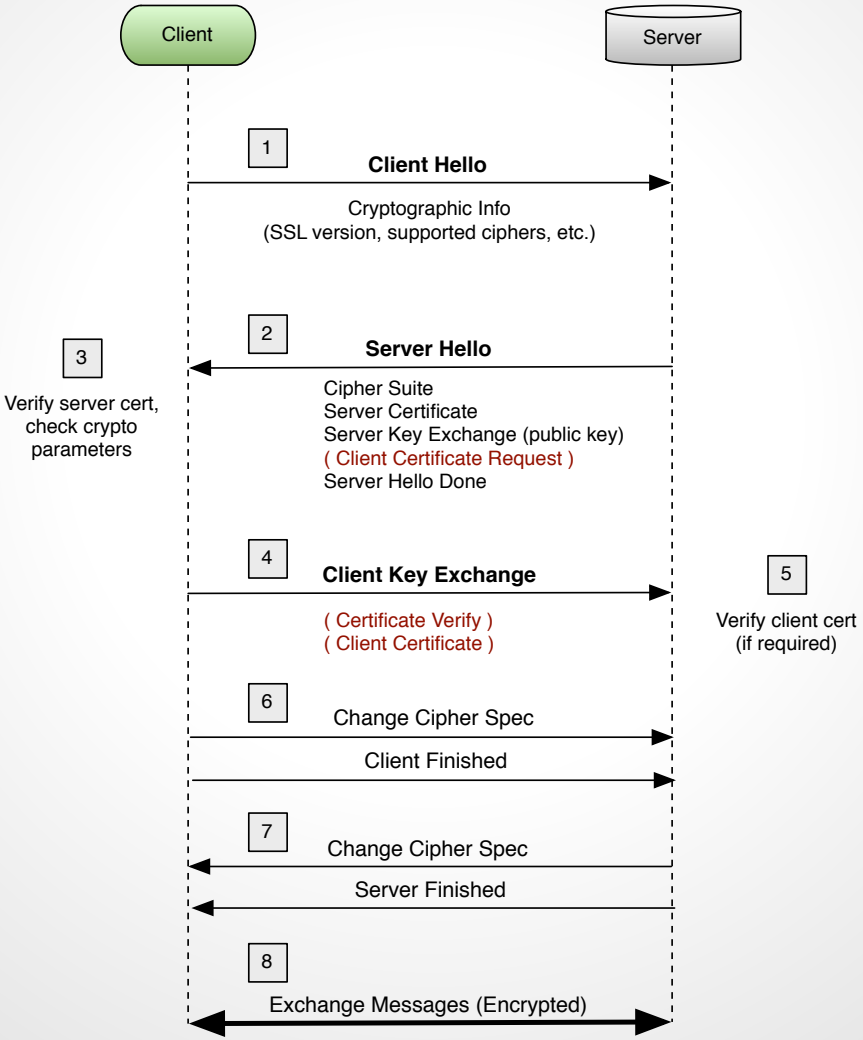
SSL: Encryption

- A common **CIPHER SUITE** is negotiated

Protocol_keyexchange_WITH_bulkencryption_mode_messageauth

SSL_RSA_WITH_DES_CBC_SHA
SSL_DHE_RSA_WITH_DES_CBC_SHA
TLS_RSA_WITH_AES_128_CBC_SHA
TLS_DHE_DSS_WITH_AES_128_CBC_SHA
TLS_DHE_RSA_WITH_AES_256_CBC_SHA

SSL: Handshake



Where is SSL used?

Everywhere!

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SSL: Where is it used?

- Energy Monitoring
- Gaming
- Databases
- Sensors
- VoIP
- M2M communication
- And much more...

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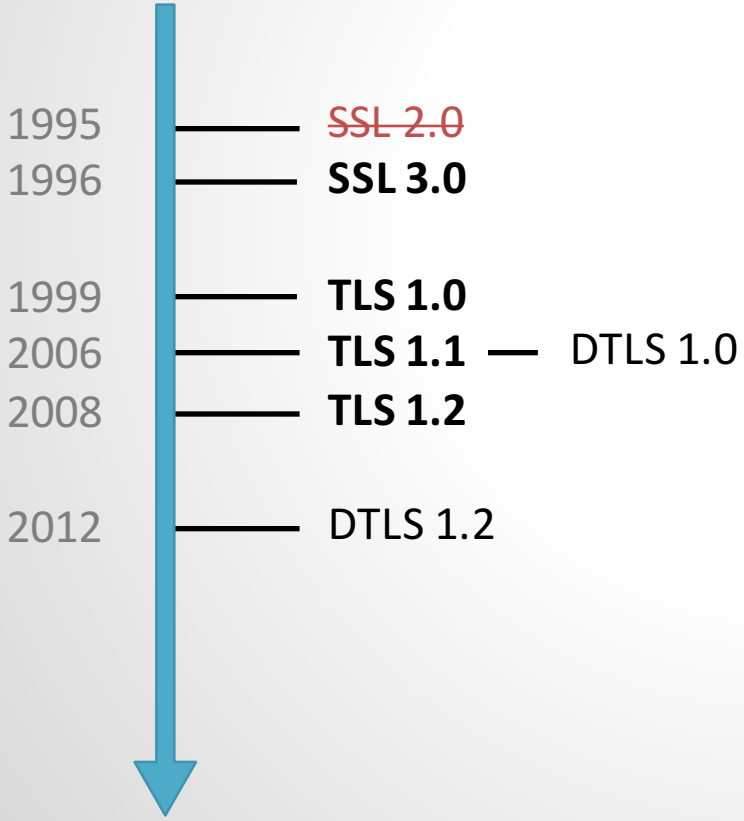
What to look for?

When shopping for an SSL stack.

1: Protocols

- Support for current protocols?



Notes:

- SSL 2.0 is insecure
- SSL = “Secure Sockets Layer”
- TLS = “Transport Layer Security”
- DTLS = “Datagram TLS”

2: Ciphers

- Support for needed cipher suites?

Public Key	Block / Stream	Hash
RSA, DSS, DH, NTRU …	DES, 3DES, AES, ARC4, RABBIT, HC-128 …	MD2, MD4, MD5, SHA-128, SHA-256, RIPEMD …

Ex: TLS_RSA_WITH_AES_128_CBC_SHA

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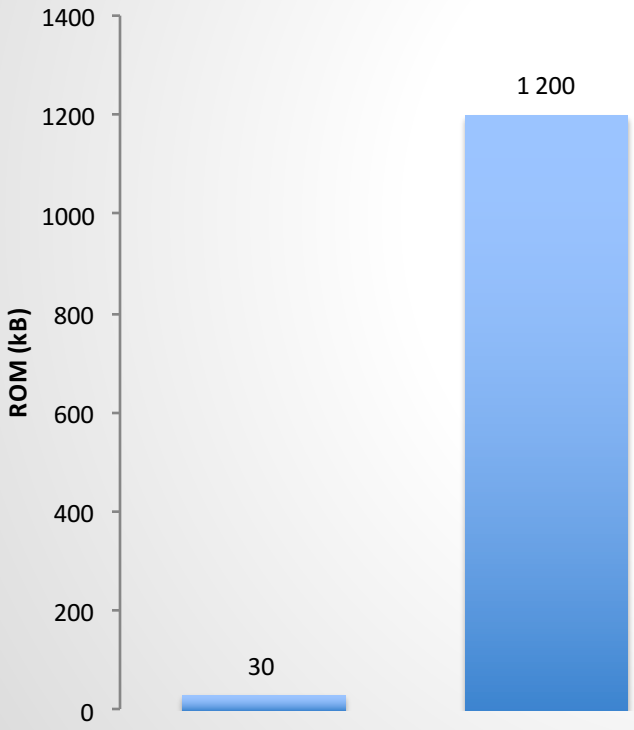
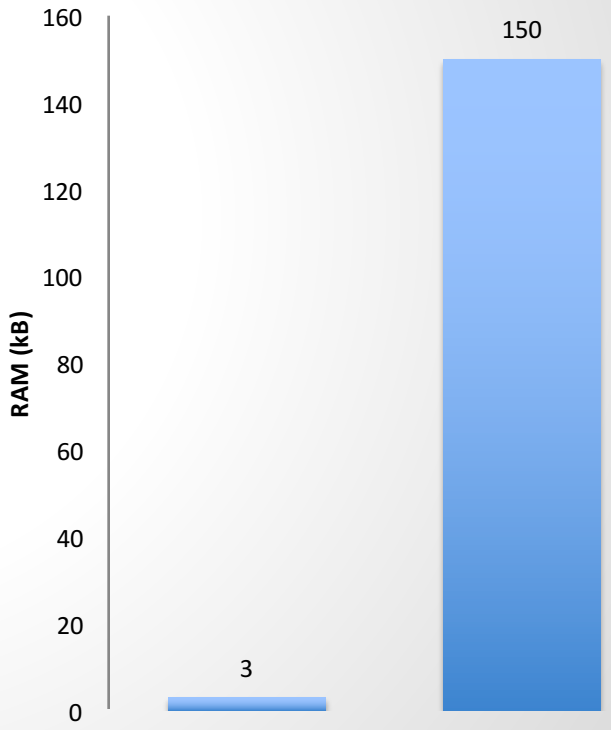
3: Memory Usage

- ROM / RAM usage





4: Simple to Use

- Learning curve?
- Myth: Encryption is too hard to use.

5: Portability

- OS support out-of-the-box?
- Customizable?

5: Portability

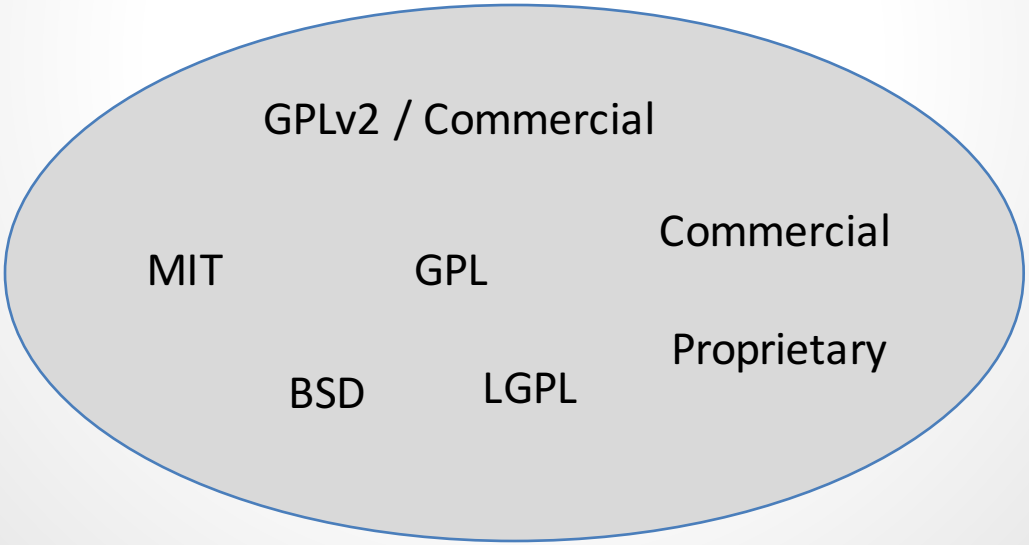
- In Progress…

6: Hardware Acceleration

- Support for hardware acceleration?
  - You bet!
- Assembly code optimizations
  - Absolutely!

7: License

- Flexible license model?
- Does it meet your license needs?



8: Maturity

- Track record?
  - wolfSSL has only had 3 critical vulnerabilities since it's inception in 2004 all of which were immediately fixed and a RELEASE went out to our customers in under 48 hours!
- Code origin?
  - Clean house implementation!
- Actively developed?
  - wolfSSL targets a RELEASE every 3 months.

9: Compatibility

- Is interoperability testing being conducted?
  - Jenkins Continuous Integration .
  - Constantly adding more OE's to our slave network.

- What browsers is the library actively tested against?
  - Chrome, IE, EDGE, Firefox, Safari and more.

10: Crypto Access

- Direct access to crypto?

Many reasons:

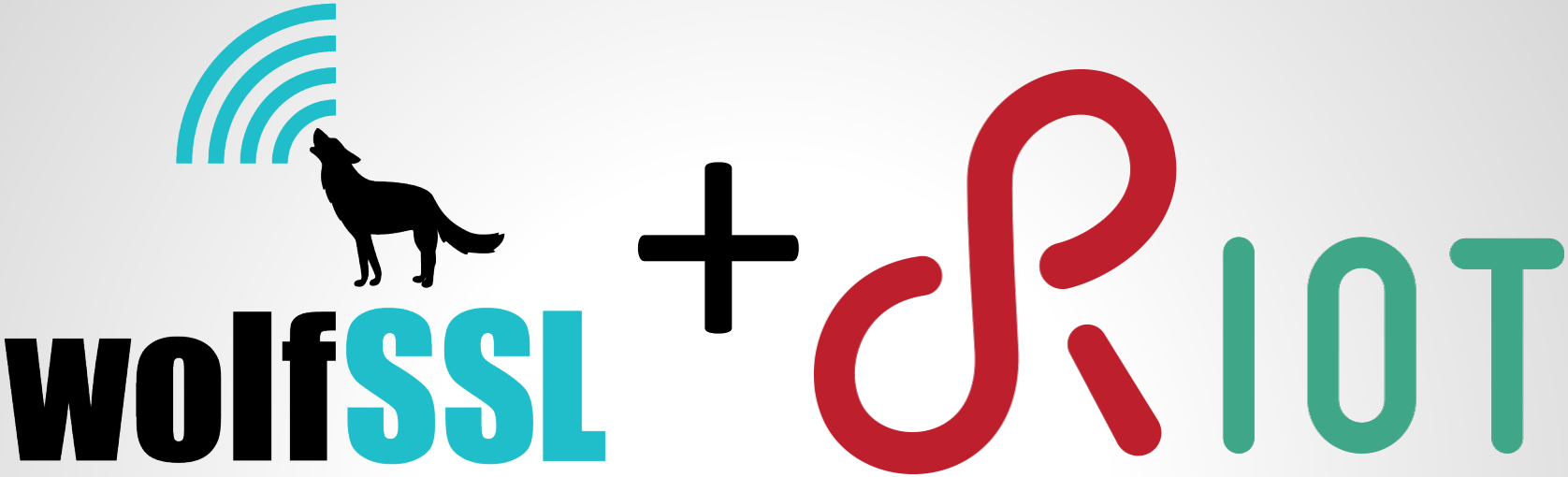
- Direct encryption
- Code Signing
- Verifying hashes, etc.

11: Support

- What happens if:
  - Something goes wrong
  - You can't get it to work on your system
  - New vulnerability comes out
  - You need a new cipher/feature
- Is there support available to help you out?

SSL: Shopping List

1. Protocols
2. Ciphers
3. Memory Usage
4. Simple to Use
5. Portability
6. Hardware Acceleration
7. License
8. Maturity
9. Compatibility
10. Crypto Access
11. Support



Thanks!

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kaleb@wolfssl.com

info@wolfssl.com