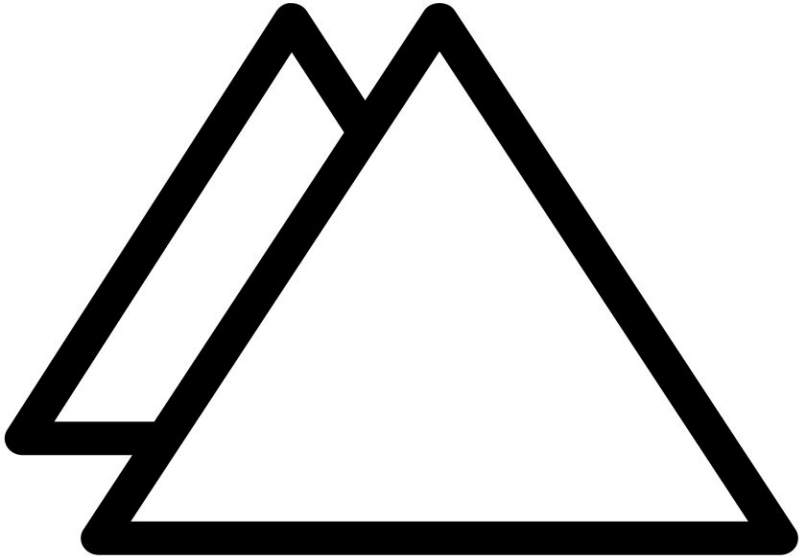
Kubelet to Istio: Kubernetes Network Security Demystified

FOSDEM SPEED RUN

@sublimino and @controlplaneio


I’m:
- Andy
- Dev-like
- Sec-ish
- Ops-y



controlplane

What is Network Security

controlplane

Why do we need Network Security?

@sublimino

controlplane

Happy Path Application Design

How Applications Run in “Piratical Reality™”

How Kubernetes does it

kubernetes

controlplane

Self Signed Certs. Always a bad thing?

controlplane

Takeaway: Encrypt Everything Everywhere

@sublimino

controlplane

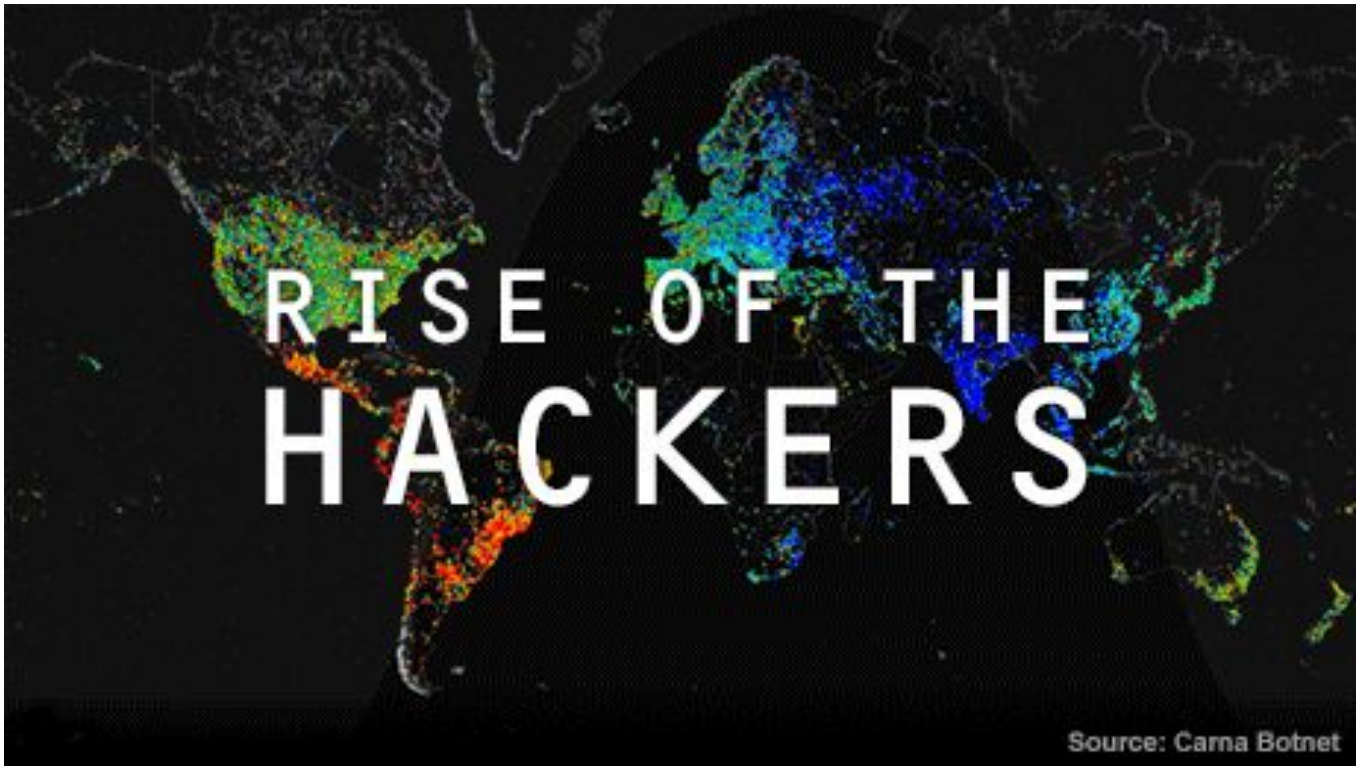
What this talk is about

- Network Security 101
- Kubernetes API Components
- TLS, X.509, and Mutual Authentication
- CNI and Network Policies for Applications
- Bootstrapping Identity with SPIFFE

Network Security 101

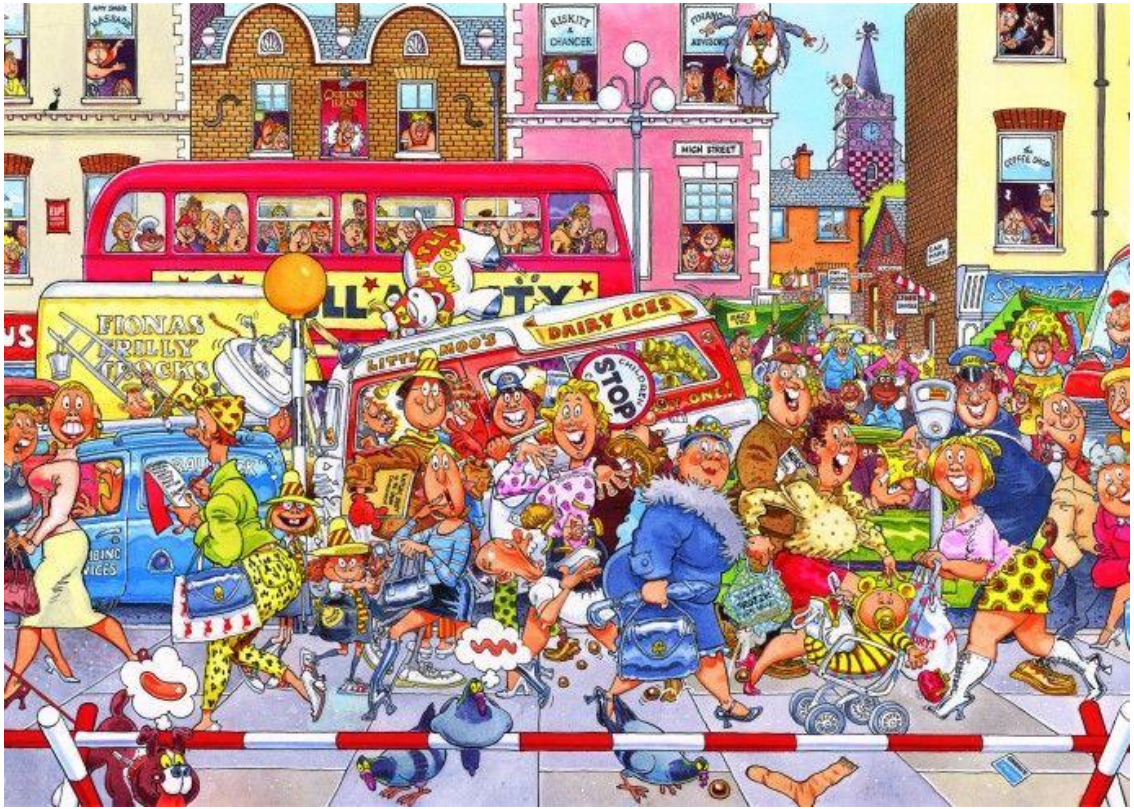
@sublimino

Private & Trusted Communications



Human Communication: Trusted and Local

Human Communication: Untrusted and Local



@sublimino

controlplane

Human Communication: Untrusted and Remote

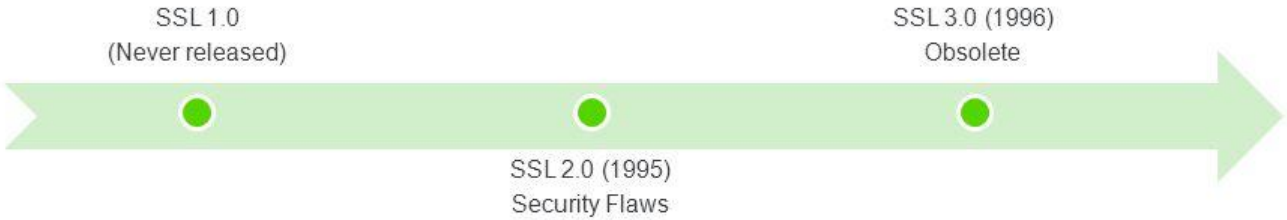
In Internet Prehistory...

@sublimino

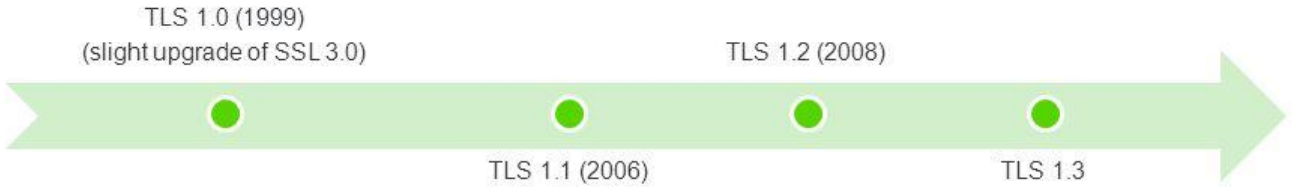
controlplane

SSL/TLS – A brief history lesson

Secure Socket Layer (SSL) – Originated in Netscape Web browser



Transport Layer Security(TLS) – Standardized by IETF



http:/slideplayer.com/slide/11456904/

Is it really that simple?

@sublimino

controlplane

@sublimino

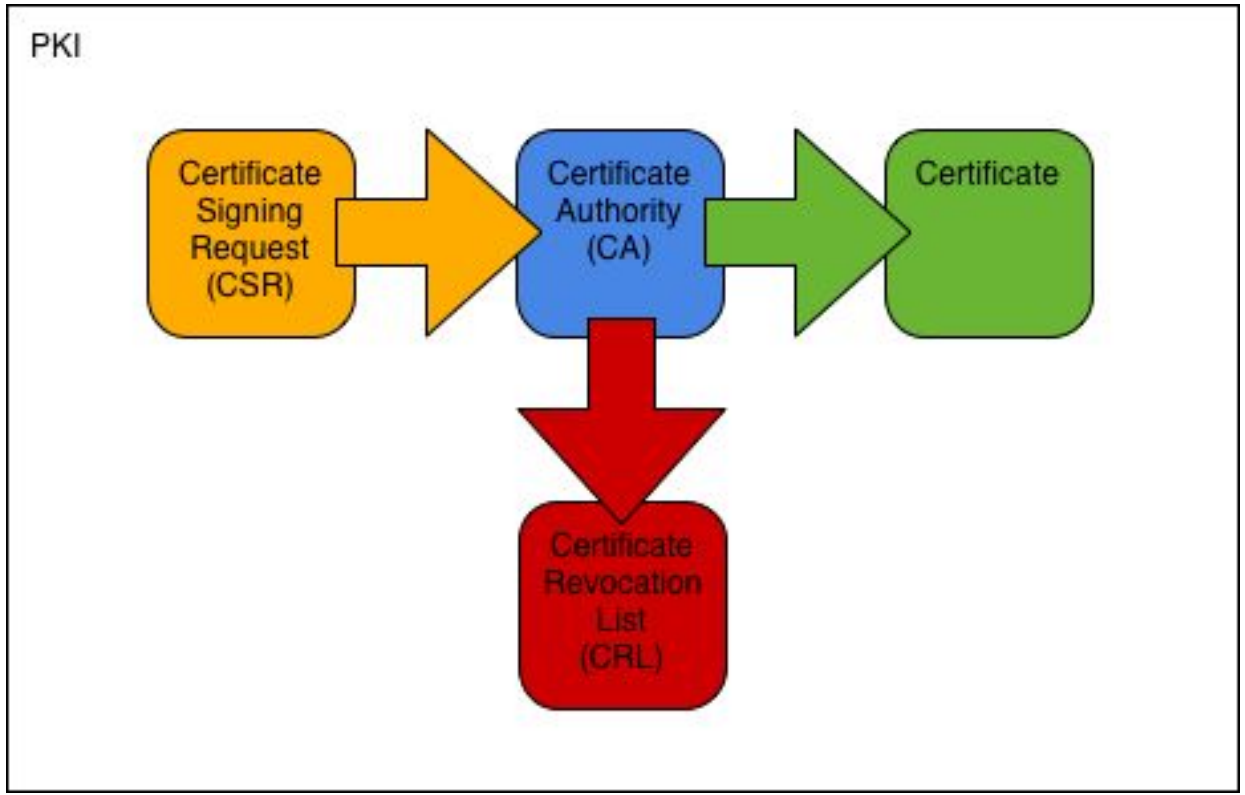
controlplane

Securing API Server Traffic

Securing API Server Traffic

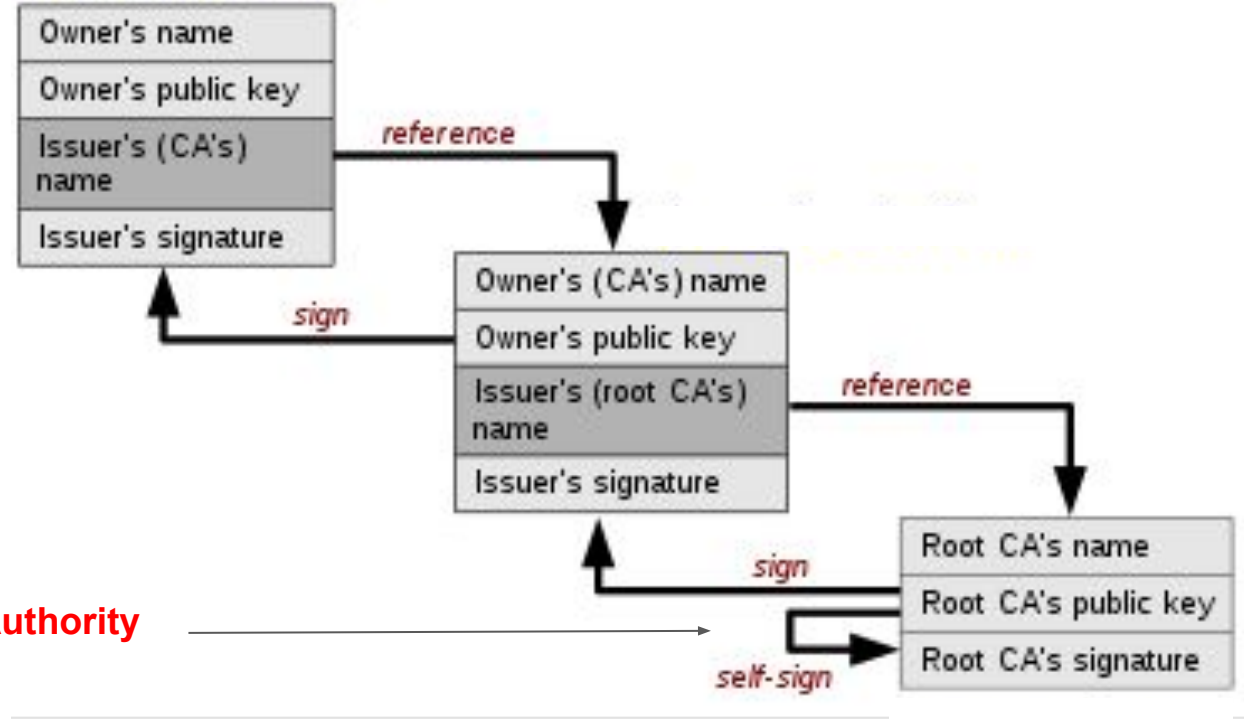
```
kube-apiserver
...
--client-ca-file=/secret/authca.pem
...
--etcd-cafile=/secret/ca.pem
--etcd-certfile=/secret/cert.pem
--etcd-keyfile=/secret/key.pem
--experimental-encryption-provider-config=/secret/encryption.cfg
...
--kubelet-certificate-authority=/secret/ca.pem
--kubelet-client-certificate=/secret/cert.pem
--kubelet-client-key=/secret/key.pem
...
--oidc-ca-file=/secret/ca.pem
...
--service-account-key-file=/secret/service_account_key.pem
...
--tls-ca-file=/secret/ca.pem
--tls-cert-file=/secret/cert.pem
--tls-private-key-file=/secret/key.pem
--tls-sni-cert-key=/secret/cert.pem,/secret/key.pem:localhost
--tls-sni-cert-key=/secret/controller/cert.pem,/secret/controller/key.pem
...
```


Securing API Server Traffic



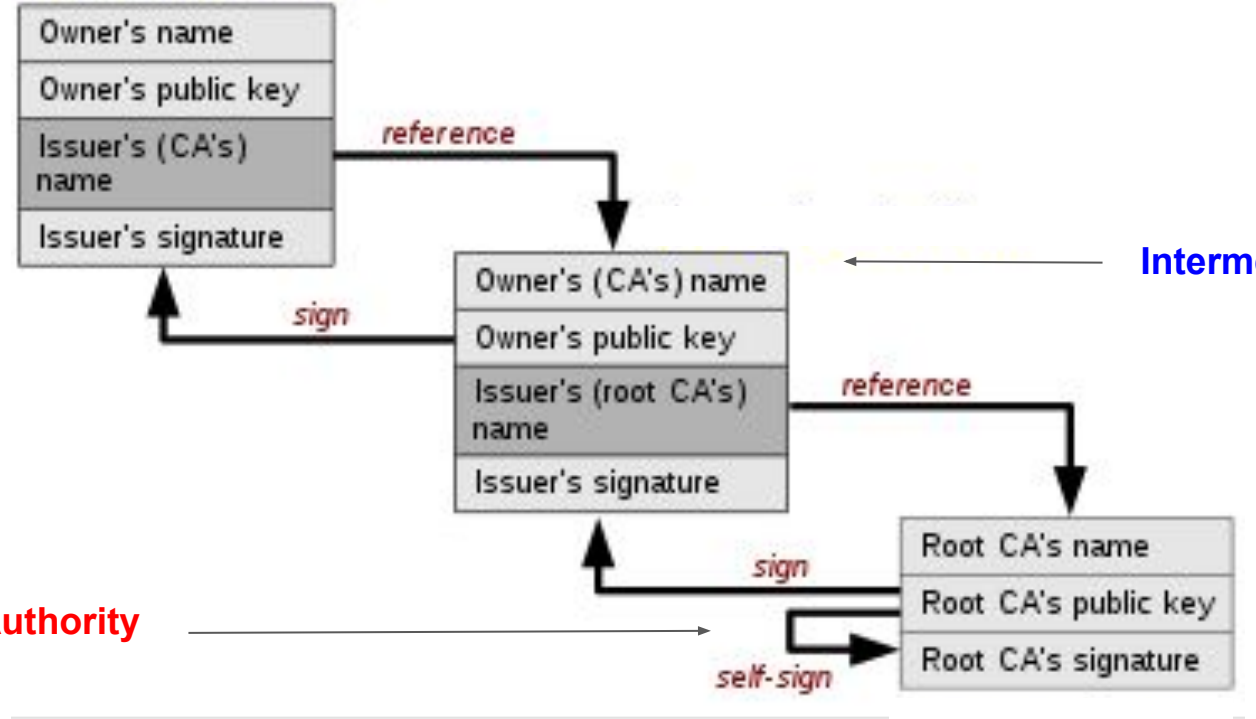
controlplane

Securing API Server Traffic



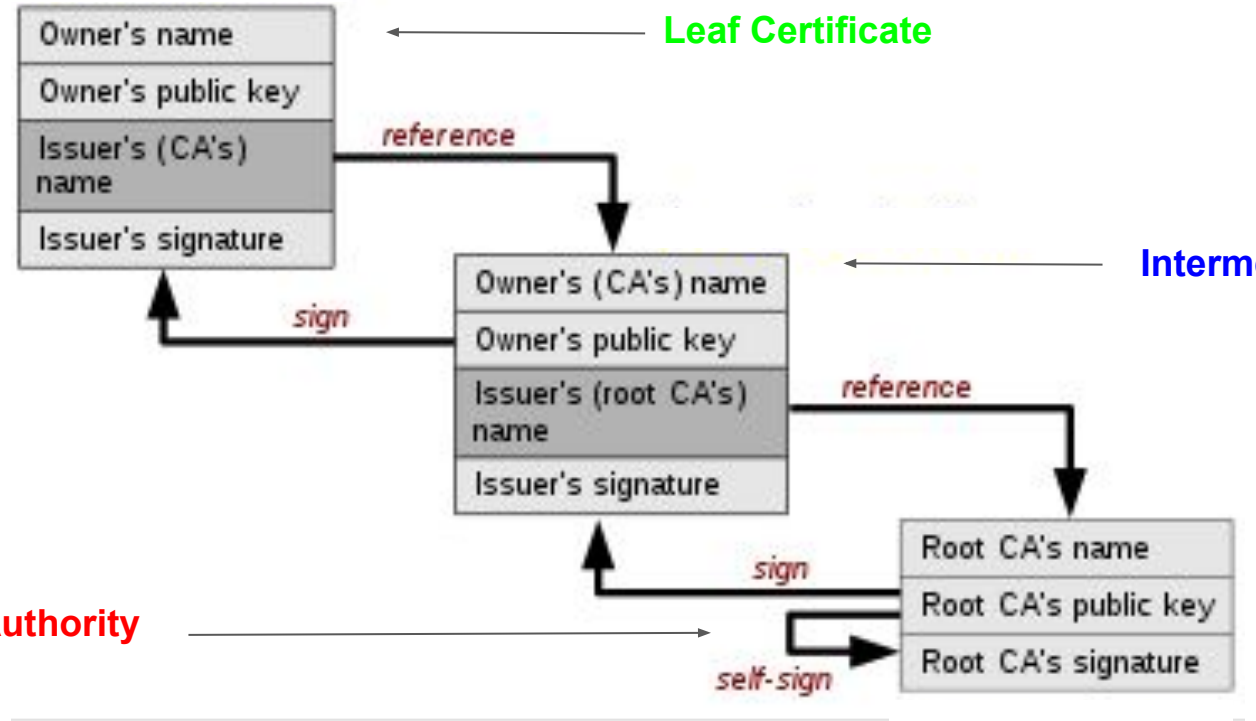
Certificate Authority

Securing API Server Traffic



controlplane

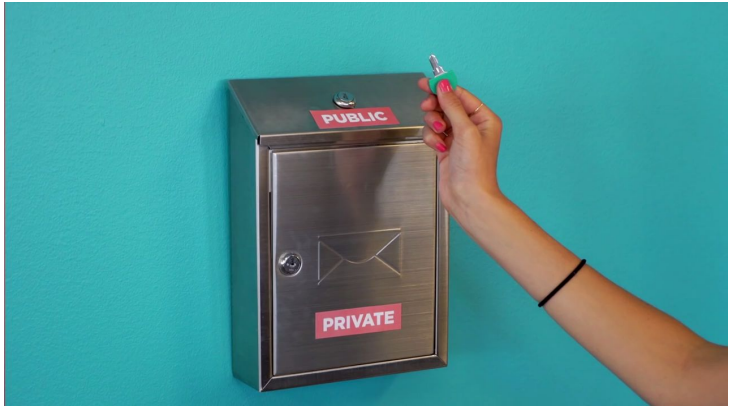
Securing API Server Traffic



controlplane

TLS, X.509, and mutual authentication

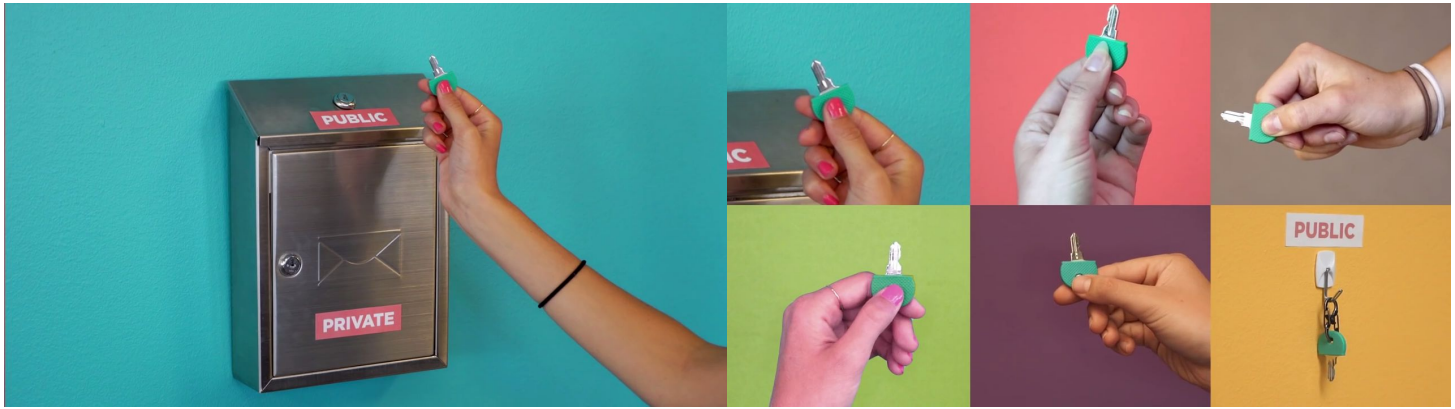
Public Key Cryptography



@sublimino

controlplane

Public Key Cryptography



@sublimino

controlplane

Public Key Cryptography

@sublimino

controlplane

Public Key Cryptography

@sublimino

controlplane

Woah there, how does it work?

Woah there, how does it work?

- Symmetric encryption

Woah there, how does it work?

- Symmetric encryption: identical keys to lock and unlock

Woah there, how does it work?

- Symmetric encryption: identical keys to lock and unlock
- Asymmetric encryption

Woah there, how does it work?

- Symmetric encryption: identical keys to lock and unlock
- Asymmetric encryption: different keys to lock and unlock

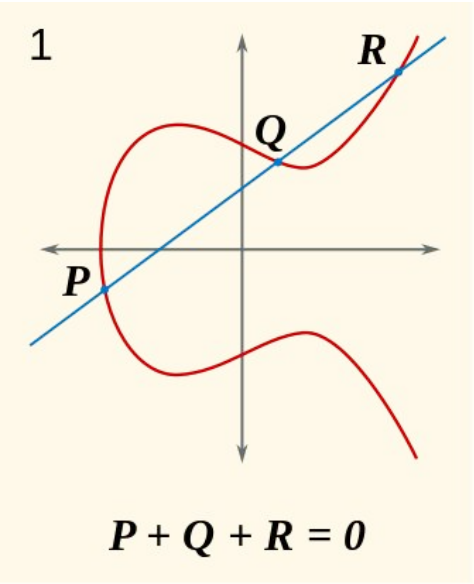
Woah there, how does it work?

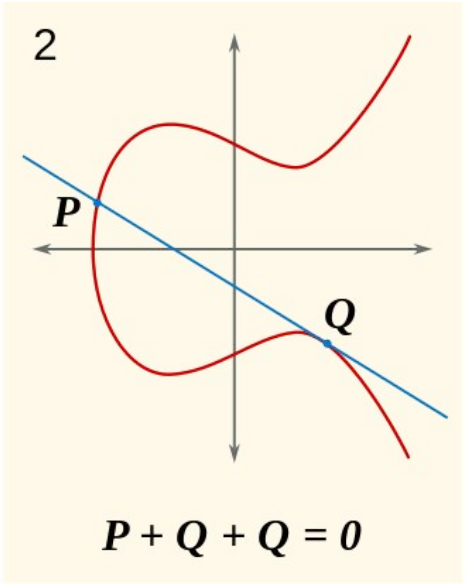
- Symmetric encryption: identical keys to lock and unlock
- Asymmetric encryption: different keys to lock and unlock
- Elliptic-curve cryptography

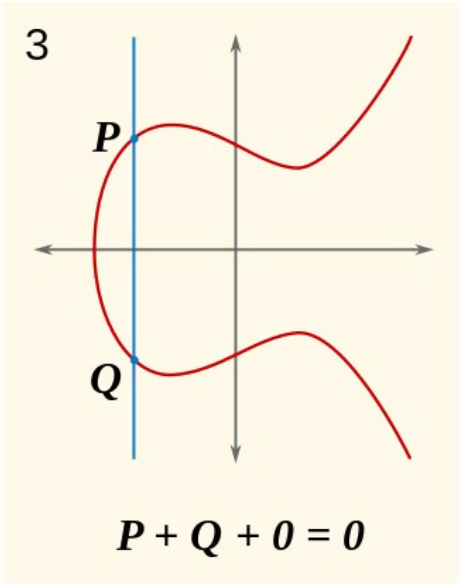
Woah there, how does it work?

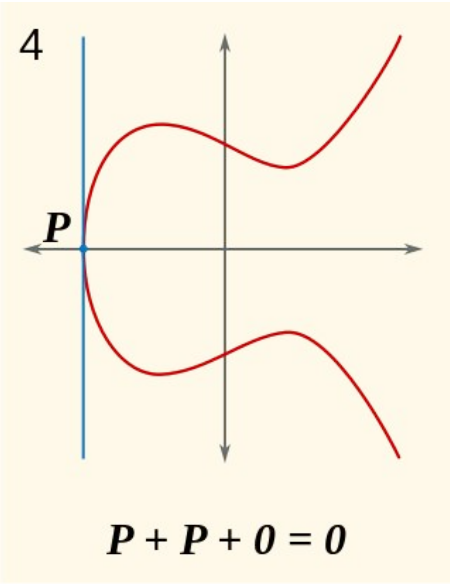
- Symmetric encryption: identical keys to lock and unlock
- Asymmetric encryption: different keys to lock and unlock
- Elliptic-curve cryptography: make brute forcing more difficult using the properties of certain graphed shapes

Elliptic Curves









controlplane

Woah there, how does it work?

- Symmetric encryption: identical keys to lock and unlock
- Asymmetric encryption: different keys to lock and unlock
- Elliptic-curve cryptography: make brute forcing more difficult using the properties of certain graphed shapes
- Diffie-Hellman

Woah there, how does it work?

- Symmetric encryption: identical keys to lock and unlock
- Asymmetric encryption: different keys to lock and unlock
- Elliptic-curve cryptography: make brute forcing more difficult using the properties of certain graphed shapes
- Diffie-Hellman: a way to create a shared encryption key without ever communicating it publicly

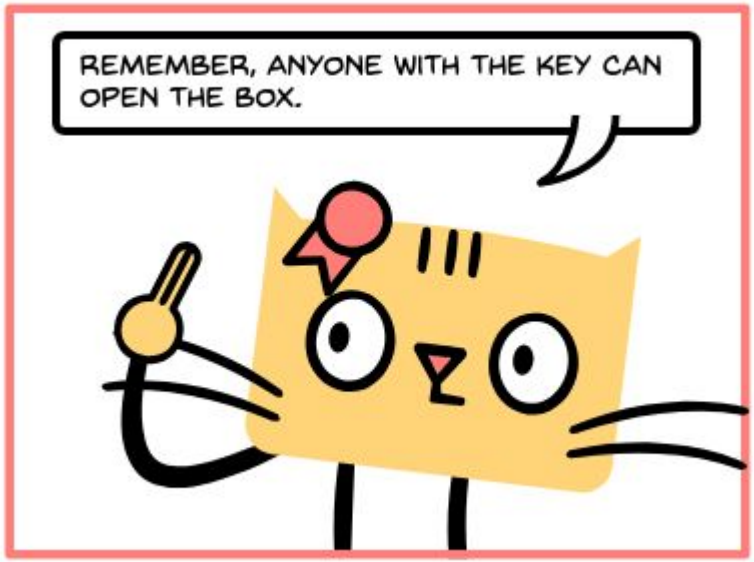
Cryptography!

- Symmetric encryption: identical keys to lock and unlock
- Asymmetric encryption: different keys to lock and unlock
- Elliptic-curve cryptography: make brute forcing more difficult using the properties of certain graphed shapes
- Diffie-Hellman: a way to create a shared encryption key without ever communicating it publically

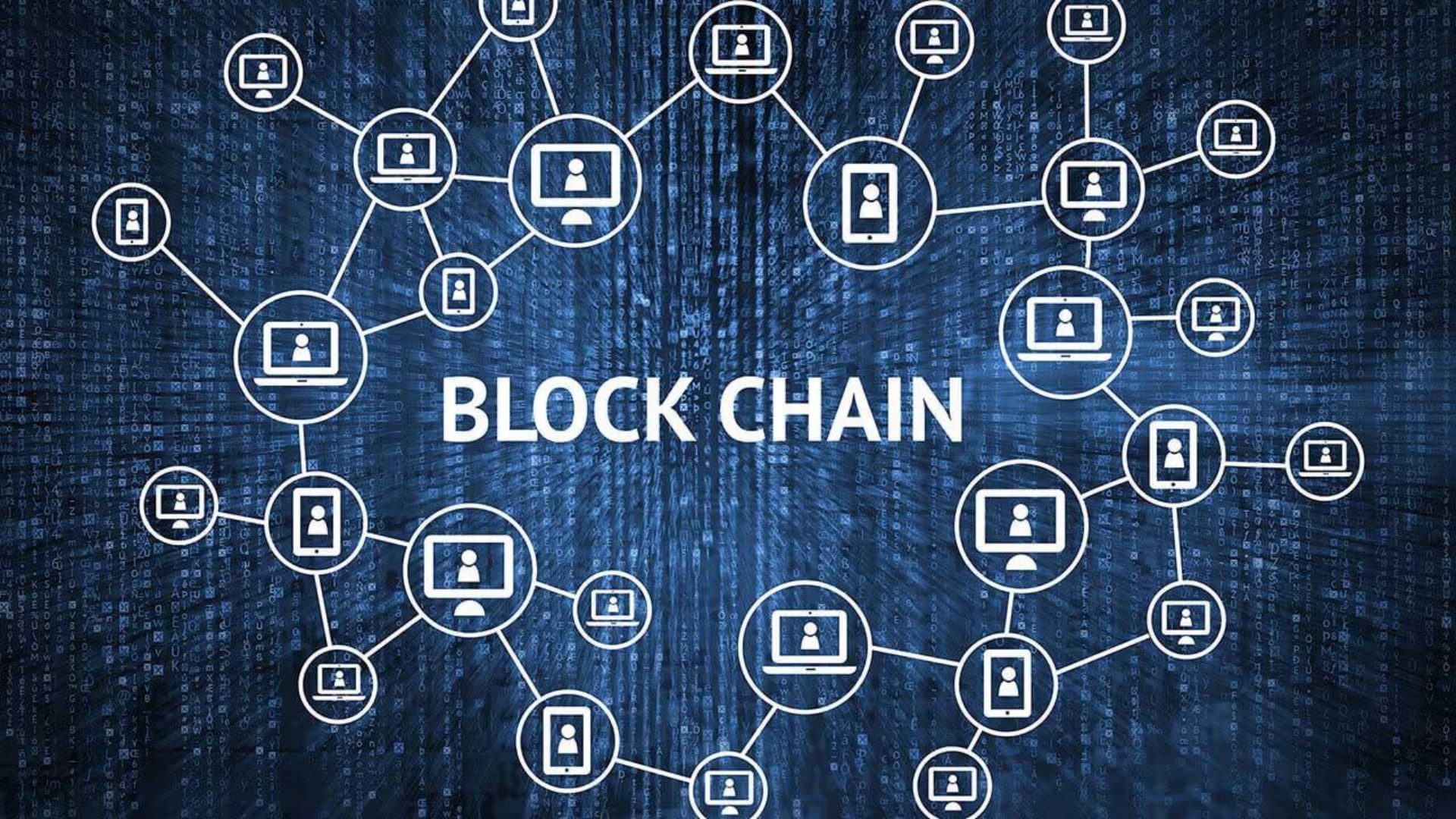
More Info

- https://www.math.auckland.ac.nz/~sgal018/crypto-book/crypto-book.html - Mathematics of Public Key Cryptography
- https://howhttps.works/

  by DNSimple

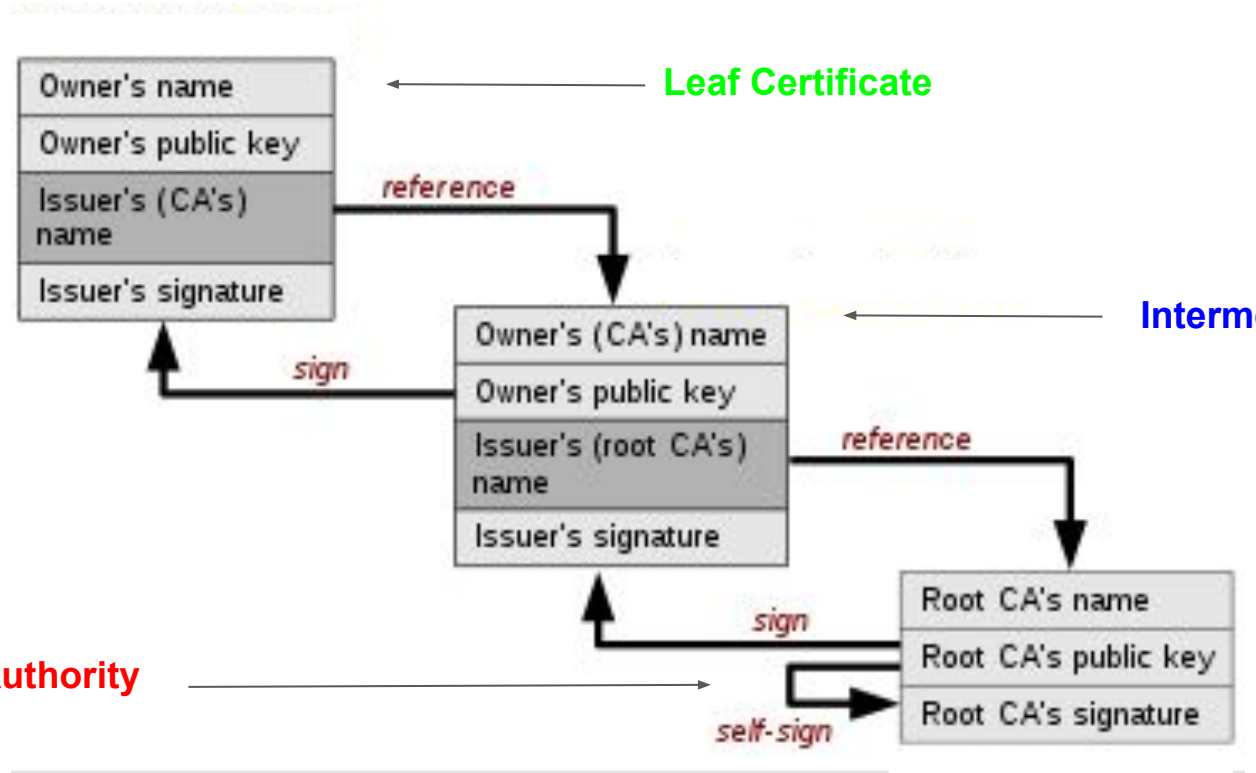


The Original Crypto!


BLOCK CHAIN

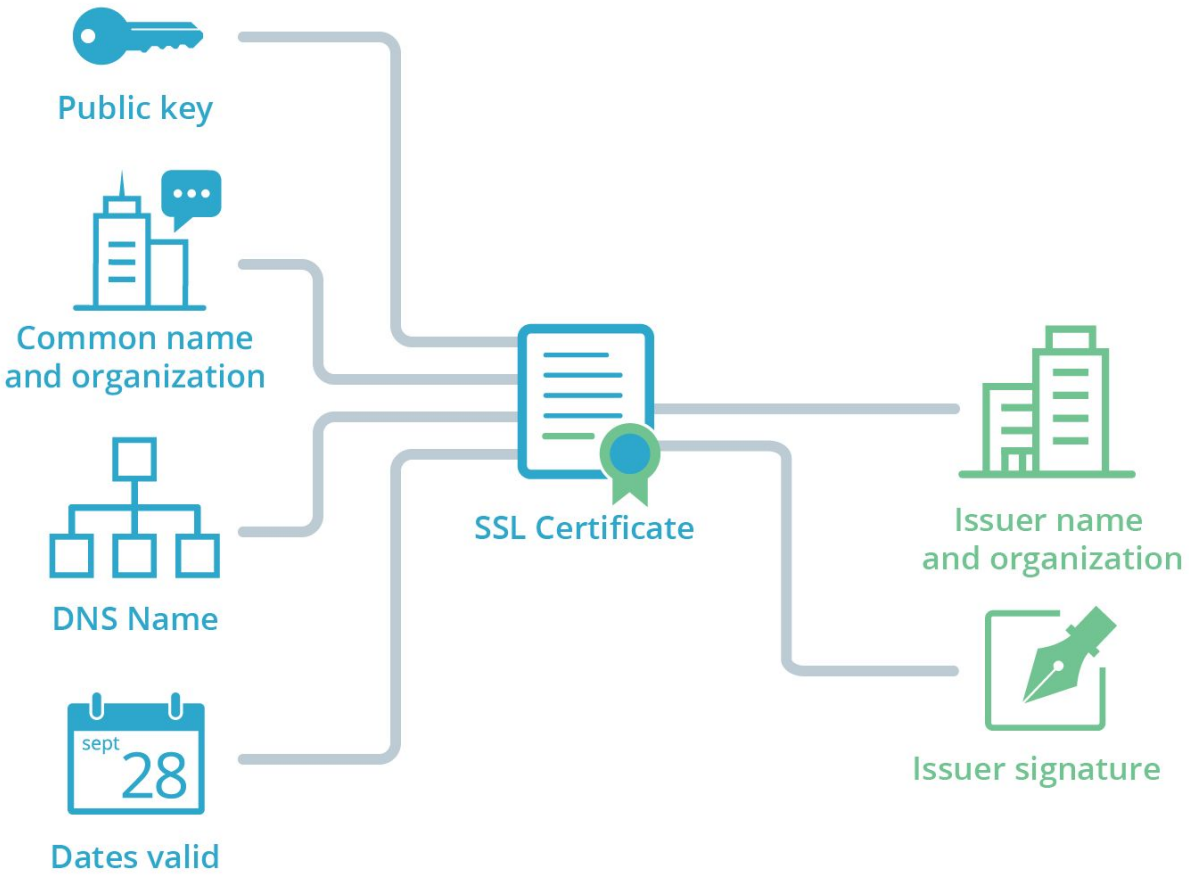
TLS in Kubernetes

Certificate Path Validation



controlplane

X.509



https://blog.cloudflare.com/content/images/2018/03/image8.png

X.509 RFC Format

```
Certificate  ::=  SEQUENCE  {
     tbsCertificate       TBSCertificate,
     signatureAlgorithm   AlgorithmIdentifier,
     signatureValue       BIT STRING  }

TBSCertificate  ::=  SEQUENCE  {
     version         [0]  EXPLICIT Version DEFAULT v1,
     serialNumber         CertificateSerialNumber,
     signature            AlgorithmIdentifier,
     issuer               Name,
     validity             Validity,
     subject              Name,
     subjectPublicKeyInfo SubjectPublicKeyInfo,
     issuerUniqueID  [1]  IMPLICIT UniqueIdentifier OPTIONAL,
                          -- If present, version MUST be v2 or v3
     subjectUniqueID [2]  IMPLICIT UniqueIdentifier OPTIONAL,
                          -- If present, version MUST be v2 or v3
     extensions      [3]  EXPLICIT Extensions OPTIONAL
                          -- If present, version MUST be v3
     }

Version  ::=  INTEGER  {  v1(0), v2(1), v3(2)  }

CertificateSerialNumber  ::=  INTEGER
```

```
Validity ::= SEQUENCE {
     notBefore      Time,
     notAfter       Time }

Time ::= CHOICE {
     utcTime        UTCTime,
     generalTime    GeneralizedTime }

UniqueIdentifier  ::=  BIT STRING

SubjectPublicKeyInfo  ::=  SEQUENCE  {
     algorithm            AlgorithmIdentifier,
     subjectPublicKey     BIT STRING  }

Extensions  ::=  SEQUENCE SIZE (1..MAX) OF Extension

Extension  ::=  SEQUENCE  {
     extnID      OBJECT IDENTIFIER,
     critical    BOOLEAN DEFAULT FALSE,
     extnValue   OCTET STRING
                 -- contains the DER encoding of an ASN.1 value
                 -- corresponding to the extension type identified
                 -- by extnID
     }
```


https://tools.ietf.org/html/rfc5280#page-35

X.509 Example Cert

```
-----BEGIN CERTIFICATE-----
MIIC2jCCAkMCAg38MA0GCSqGSIb3DQEBBQUAMIGbMQswCQYDVQQGEwJKUDEOMAwG
A1UECBMFVG9reW8xEDAOBgNVBAcTB0NodW8ta3UxETAPBgNVBAoTCEZyYW5rNERE
MRgwFgYDVQQLEw9XZWJDZXJ0IFN1cHBvcnQxGDAWBgNVBAMTD0ZyYW5rNEREIFdl
YiBDQTEjMCEGCSqGSIb3DQEJARYUc3VwcG9ydEBmcmFuazRkZC5jb20wHhcNMTIw
ODIyMDUyNzQxWhcNMTcwODIxMDUyNzQxWjBKMQswCQYDVQQGEwJKUDEOMAwGA1UE
CAwFVG9reW8xETAPBgNVBAoMCEZyYW5rNEREMRgwFgYDVQQDDA93d3cuZXhhbXBs
ZS5jb20wggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEKAoIBAQC0z9FeMynsC8+u
dvX+LciZxnh5uRj4C9S6tNeeAlIGCfQYk0zUcNFCoCkTknNQd/YEiawDLNbxBqut
bMDZ1aarys1a0lYmUeVLCIqvzBkPJTSQsCopQQ9V8WuT252zzNzs68dVGNdCJd5J
NRQykpwexmnjPPv0mvj7i8XgG379TyW6P+WWV5okeUkXJ9eJS2ouDYdR2SM9BoVW
+FgxDu6BmXhozW5EfsnajFp7HL8kQClI0QOc79yuKl3492rH6bzFsFn2lfwWy9ic
7cP8EpCTeFp1tFaD+vxBhPZkeTQ1HKx6hQ5zeHIB5ySJJZ7af2W8r4eTGYzbdRW2
4DDHCPhZAgMBAAEwDQYJKoZIhvcNAQEFBQADgYEAQMv+BFvGdMVzkQaQ3/+2noVz
/uAKbzpEL8xTcxYyP3lkOeh4FoxiSWqy5pGFALdPONoDuYFpLhjJSZaEwuvjI/Tr
rGhLV1pRG9frwDFshqD2Vaj4ENBCBh6UpeBop5+285zQ4SI7q4U9oSebUDJiuOx6
+tZ9KynmrbJpTSi0+BM=
-----END CERTIFICATE-----
```

How to decode an X.509 Cert

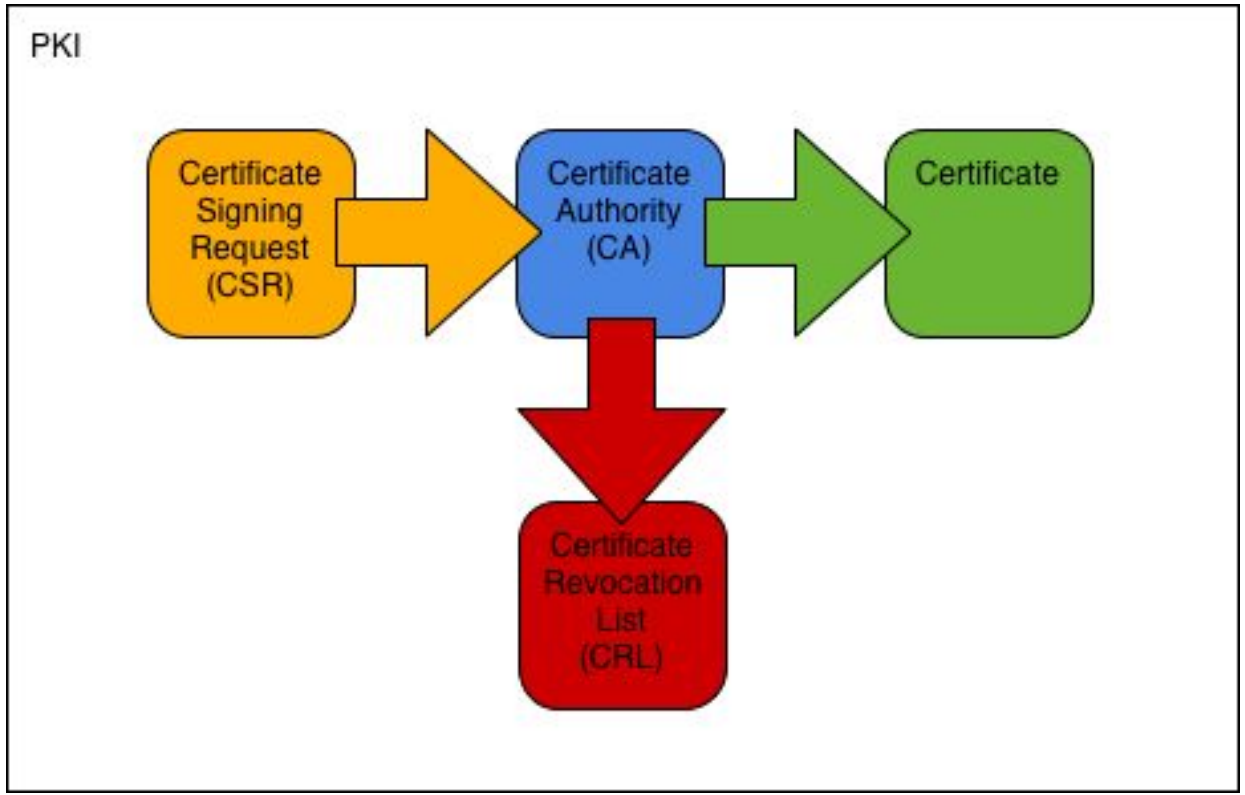
```
$ openssl s_client -connect wikipedia.org:443
CONNECTED(00000003)
depth=2 C = US, O = DigiCert Inc, OU = www.digicert.com, CN = DigiCert High Assurance EV Root CA
verify return:1
depth=1 C = US, O = DigiCert Inc, OU = www.digicert.com, CN = DigiCert SHA2 High Assurance Server CA
verify return:1
depth=0 C = US, ST = California, L = San Francisco, O = "Wikimedia Foundation, Inc.", CN = *.wikipedia.org
verify return:1
---
Certificate chain
 0 s:/C=US/ST=California/L=San Francisco/O=Wikimedia Foundation, Inc./CN=*.wikipedia.org
   i:/C=US/O=DigiCert Inc/OU=www.digicert.com/CN=DigiCert SHA2 High Assurance Server CA
 1 s:/C=US/O=DigiCert Inc/OU=www.digicert.com/CN=DigiCert SHA2 High Assurance Server CA
   i:/C=US/O=DigiCert Inc/OU=www.digicert.com/CN=DigiCert High Assurance EV Root CA
---
Server certificate
-----BEGIN CERTIFICATE-----
MIIIfDCCB2SgAwIBAgIQCDCUYtH+pgrgur/174vFRTANBgkqhkiG9w0BAQsFADBw
MQswCQYDVQQGEwJVUzEVMBMGA1UEChMMRGlnaUNlcnQgSW5jMRkwFwYDVQQLExB3
d3cuZGlnaWNlcnQuY29tMS8wLQYDVQQDEyZEaWdpQ2VydCBTSEEyIEhpZ2ggQXNz
dXJhbmNlIFNlcnZlciBDQTAeFw0xNzEyMjEwMDAwMDBaFw0xOTAxMjQxMjAwMDBa
...
```

X.509 Example Decoded Cert

```
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            10:e6:fc:62:b7:41:8a:d5:00:5e:45:b6
    Signature Algorithm: sha256WithRSAEncryption
        Issuer: C=BE, O=GlobalSign nv-sa, CN=GlobalSign Organization Validation CA - SHA256 - G2
        Validity
            Not Before: Nov 21 08:00:00 2016 GMT
            Not After : Nov 22 07:59:59 2017 GMT
        Subject: C=US, ST=California, L=San Francisco, O=Wikimedia Foundation, Inc.,
CN=*.wikipedia.org
        Subject Public Key Info:
            Public Key Algorithm: id-ecPublicKey
                Public-Key: (256 bit)
                pub:
                    04:c9:22:69:31:8a:d6:6c:ea:da:c3:7f:2c:ac:a5:
                    af:c0:02:ea:81:cb:65:b9:fd:0c:6d:46:5b:c9:1e:
                    ed:b2:ac:2a:1b:4a:ec:80:7b:e7:1a:51:e0:df:f7:
                    c7:4a:20:7b:91:4b:20:07:21:ce:cf:68:65:8c:c6:
                    9d:3b:ef:d5:c1
                ASN1 OID: prime256v1
                NIST CURVE: P-256
        X509v3 extensions:
            X509v3 Key Usage: critical
                Digital Signature, Key Agreement
            Authority Information Access:
                CA Issuers - URI:http://secure.globalsign.com/cacert/gsorganizationvalsha2g2r1.crt
                OCSP - URI:http://ocsp2.globalsign.com/gsorganizationvalsha2g2

X509v3 Certificate Policies:
                Policy: 1.3.6.1.4.1.4146.1.20
                  CPS: https://www.globalsign.com/repository/
                Policy: 2.23.140.1.2.2

            X509v3 Basic Constraints:
                CA:FALSE
            X509v3 CRL Distribution Points:

                Full Name:
                  URI:http://crl.globalsign.com/gs/gsorganizationvalsha2g2.crl

            X509v3 Subject Alternative Name:
                DNS:*.wikipedia.org, DNS:*.m.mediawiki.org, DNS:*.m.wikibooks.org, ...
            X509v3 Extended Key Usage:
                TLS Web Server Authentication, TLS Web Client Authentication
            X509v3 Subject Key Identifier:
                28:2A:26:2A:57:8B:3B:CE:B4:D6:AB:54:EF:D7:38:21:2C:49:5C:36
            X509v3 Authority Key Identifier:
                keyid:96:DE:61:F1:BD:1C:16:29:53:1C:C0:CC:7D:3B:83:00:40:E6:1A:7C

    Signature Algorithm: sha256WithRSAEncryption
         8b:c3:ed:d1:9d:39:6f:af:40:72:bd:1e:18:5e:30:54:23:35:
         ...
```

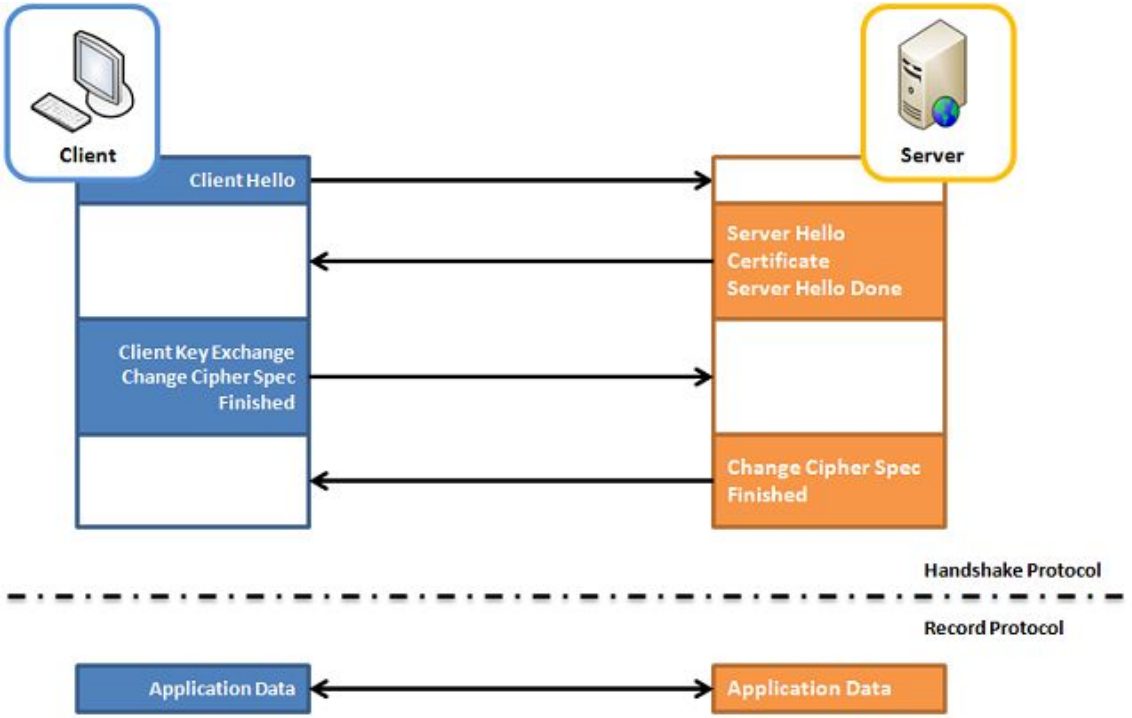

https://tools.ietf.org/html/rfc5280#page-35

Self Signed Certs aka Signing Your Own Homework



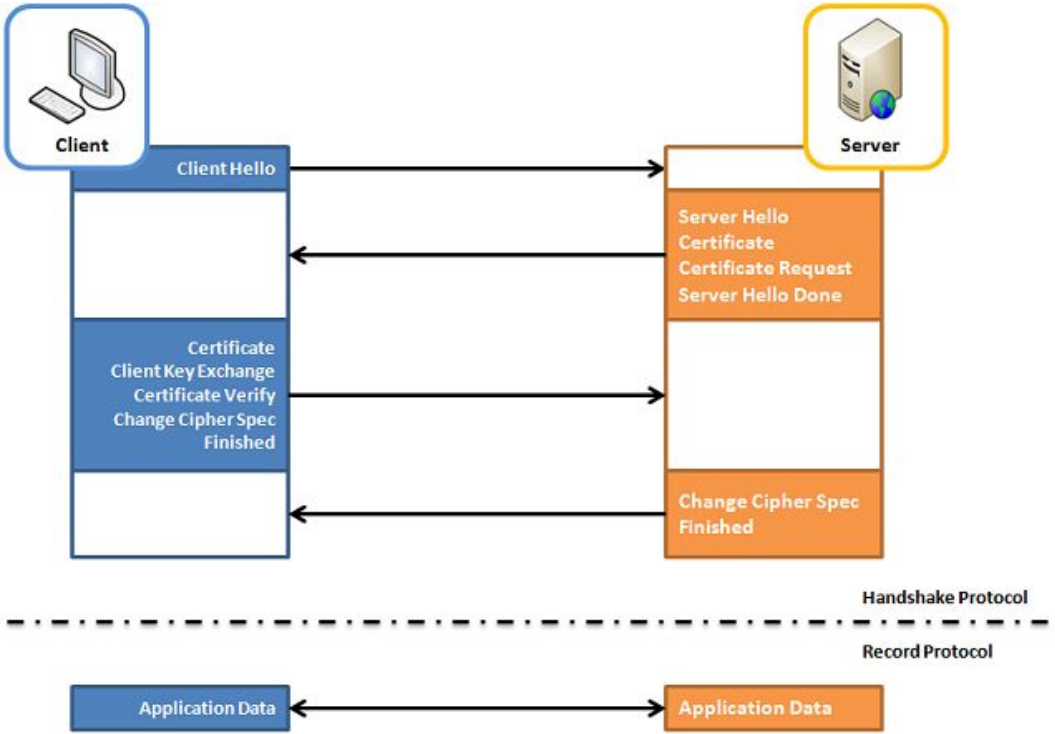
controlplane

One-Way (Traditional) TLS Handshake



SSL authentication handshake messages

Mutual TLS Handshake (mTLS)



Mutual SSL authentication handshake messages

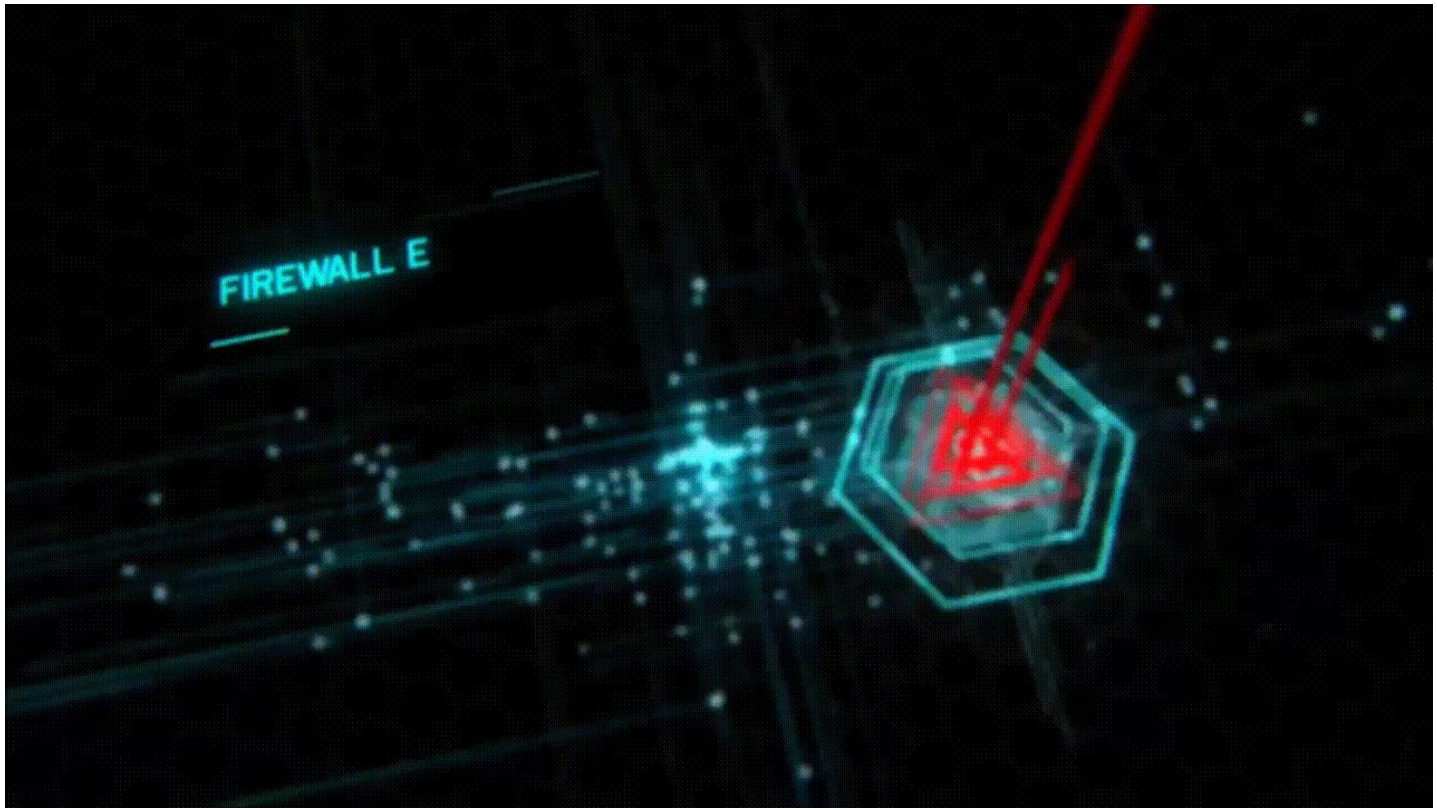
Private & Trusted Communications

@sublimino

controlplane

Securing API Server Traffic

Don't we trust our networks and firewalls?

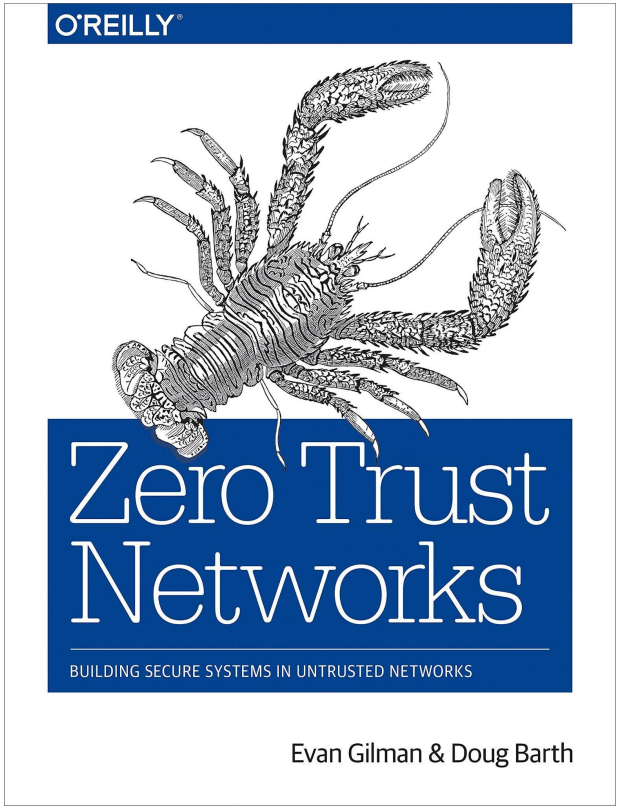


@sublimino

controlplane

BeyondCorp

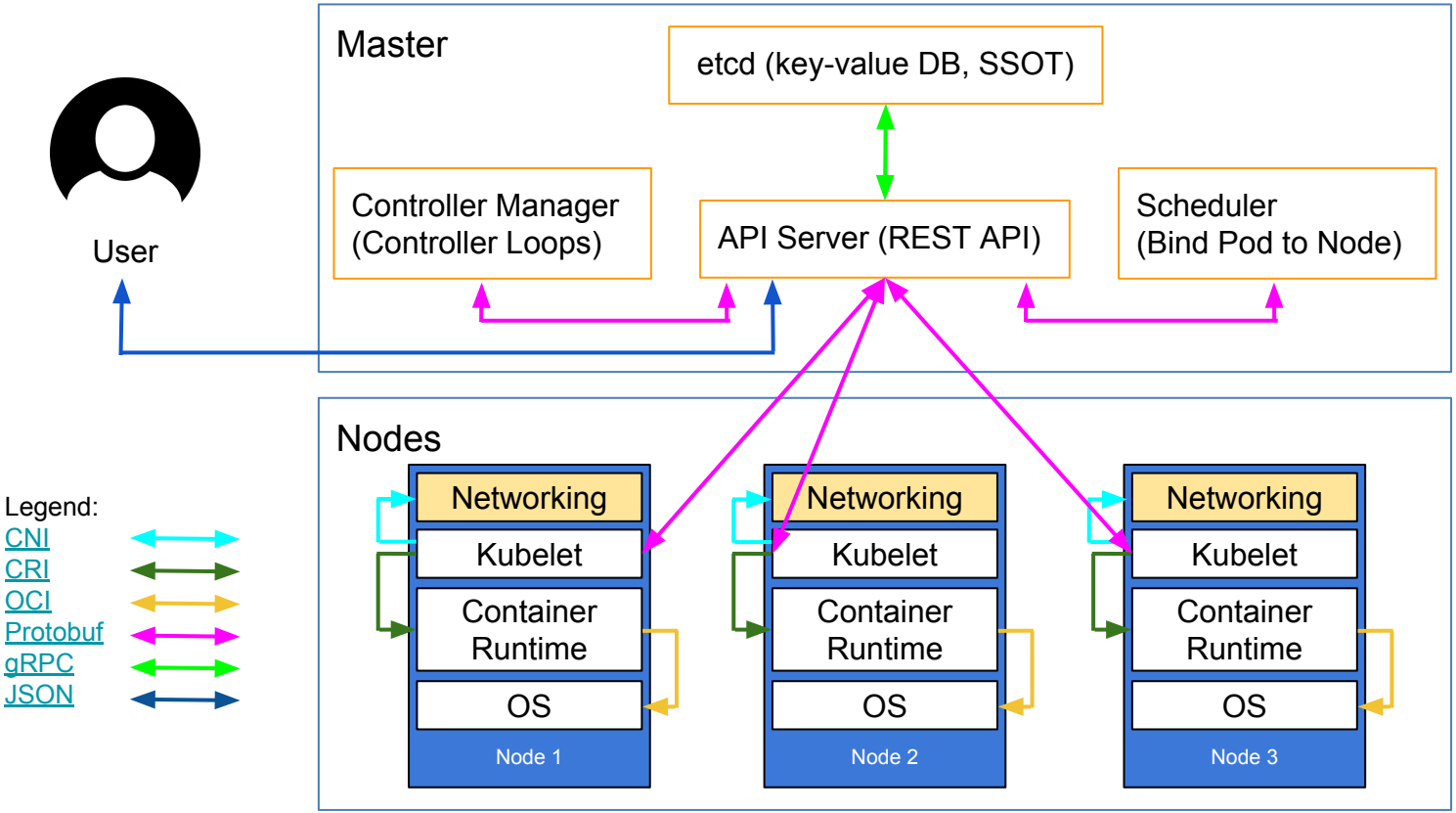
Zero Trust Networking



controlplane

Zero Trust API Server?

controlplane



By Lucas Käldström

@sublimino

controlplane

What could possibly go wrong?

controlplane


GAME
OVER

What could possibly go wrong?

controlplane

Game Over?

What could possibly go wrong?

controlplane

Would you like to
continue?

Continuous (Kubernetes) Security

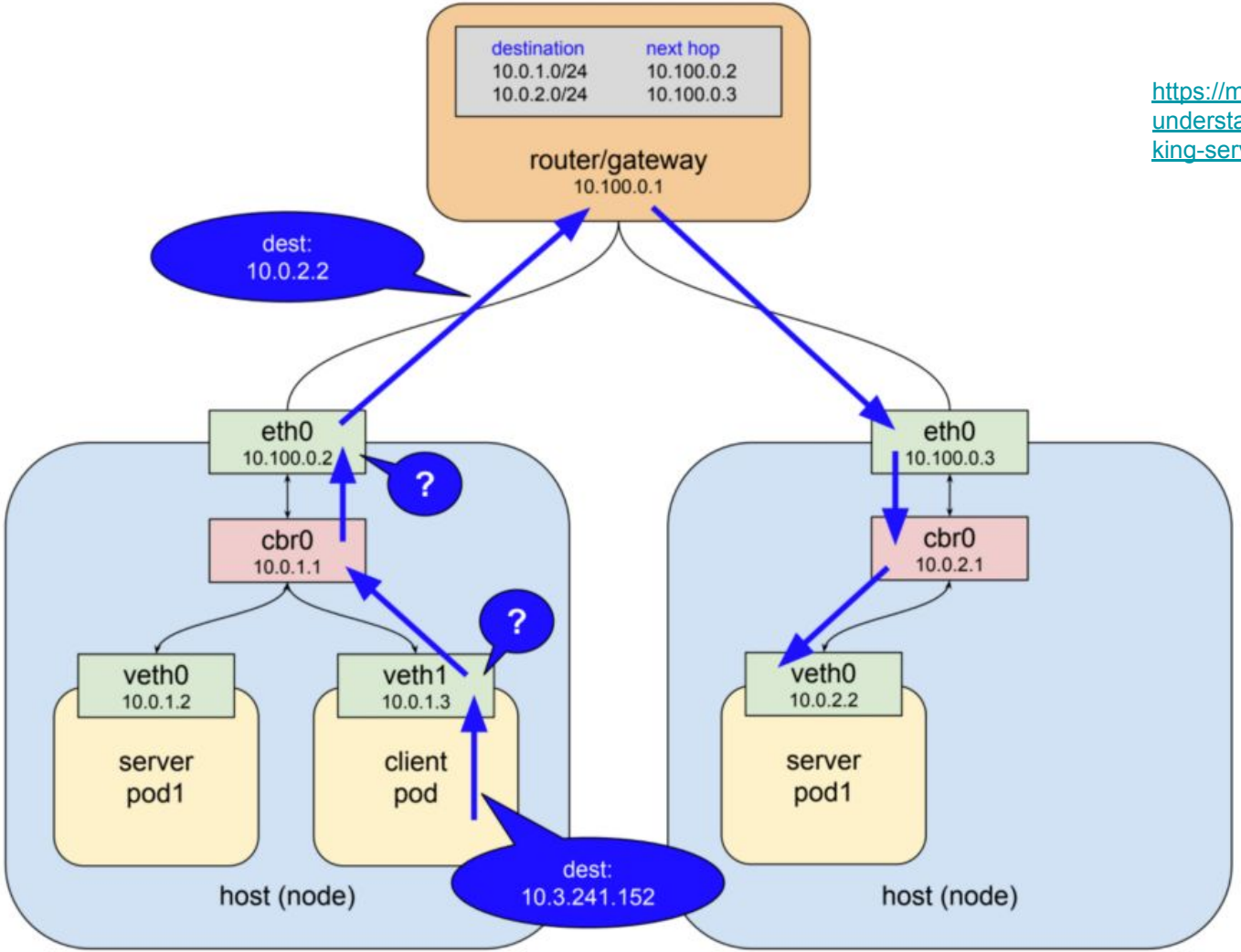
[Slides](#) / [@sublimino](#)

controlplane

Application Layer

Containers and Traditional Network Security?

controlplane



https://medium.com/google-cloud/understanding-kubernetes-networking-services-f0cb48e4cc82

controlplane

```
apiVersion: networking.k8s.io/v1
kind: NetworkPolicy
metadata:
  name: default-deny
spec:
  podSelector:
```

https://github.com/ahmetb/kubernetes-network-policy-recipes

Kubernetes NetworkPolicy: default deny

```
apiVersion: networking.k8s.io/v1
kind: NetworkPolicy
metadata:
  name: default-deny
spec:
  podSelector:
    - “*”
```

Illegal syntax, but represents what it actually does (effectively a wildcard)

https://github.com/ahmetb/kubernetes-network-policy-recipes

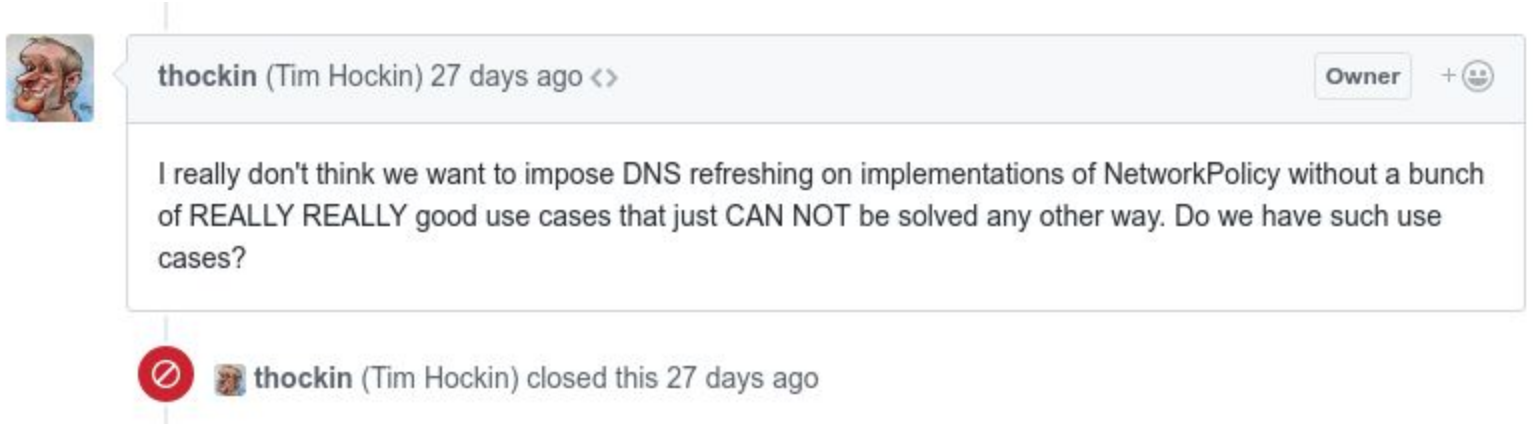
Kubernetes NetworkPolicy: default deny

```
apiVersion: networking.k8s.io/v1
kind: NetworkPolicy
metadata:
  name: foo-deny-external-egress
spec:
  podSelector:
    matchLabels:
      app: foo
  policyTypes:
  - Egress
  egress:
  - ports:
    - port: 53
      protocol: UDP
    - port: 53
      protocol: TCP
  - to:
    - namespaceSelector: {}
```

https://github.com/ahmetb/kubernetes-network-policy-recipes

Kubernetes NetworkPolicy

controlplane



https://github.com/kubernetes/kubernetes/issues/56901

Kubernetes NetworkPolicy - NO DNS NAMES

controlplane

```
apiVersion: networking.k8s.io/v1
kind: NetworkPolicy
metadata:
  name: foo-deny-external-egress
spec:
  podSelector:
    dnsName: control-plane.io
  policyTypes:
  - Egress
  egress:
  - ports:
    - port: 53
      protocol: UDP
    - port: 53
      protocol: TCP
  - to:
    - namespaceSelector: {}
```

ILLEGAL! NOT ALLOWED!

https://github.com/ahmetb/kubernetes-network-policy-recipes

Kubernetes NetworkPolicy - ILLEGAL!

controlplane

`netassert` - cloud native network testing

- netassert - network security testing for DevSecOps workflows
  https://github.com/controlplaneio/netassert

```
host:
  localhost:
    bitbucket.com:
      - 22
  control-plane.io:
    github.com:
      - 22
```


controlplane

`netassert` - cloud native network testing

```
k8s: # used for Kubernetes pods
  deployment: # only deployments currently supported
    test-frontend: # pod name, defaults to `default` namespace
      test-microservice: 80 # `test-microservice` is the DNS name of the target service
      test-database: -80    # should not be able to access port 80 of `test-database`

    new-namespace:test-microservice:  # `new-namespace` is the namespace name
      test-database.new-namespace: 80 # longer DNS names can be used for other namespaces
      test-frontend.default: 80

    default:test-database:
      test-frontend.default.svc.cluster.local: 80 # full DNS names can be used
      test-microservice.default.svc.cluster.local: -80
      control-plane.io: 443 # we can check remote services too
```

https://github.com/controlplaneio/netassert

```
[2018-02-02T16:06:49.124+0000] ./netassert: Results: localhost
TAP version 13
# localhost TCP:30731 closed
ok 1 - localhost TCP:30731 closed
# localhost UDP:1234 closed
ok 2 - localhost UDP:1234 closed
# localhost TCP:22 open
ok 3 - localhost TCP:22 open
# binarysludge.com TCP:443 open
ok 4 - binarysludge.com TCP:443 open
# localhost TCP:999 closed
ok 5 - localhost TCP:999 closed
# control-plane.io TCP:443 open
ok 6 - control-plane.io TCP:443 open
# localhost UDP:555 closed
ok 7 - localhost UDP:555 closed
# control-plane.io TCP:80 open
ok 8 - control-plane.io TCP:80 open
# binarysludge.com TCP:22 open
ok 9 - binarysludge.com TCP:22 open
# binarysludge.com TCP:80 open
ok 10 - binarysludge.com TCP:80 open
# 8.8.8.8 UDP:53 open
ok 11 - 8.8.8.8 UDP:53 open
# google.co.uk TCP:443 open
ok 12 - google.co.uk TCP:443 open
# binarysludge.com TCP:81 open
ok 13 - binarysludge.com TCP:81 open
# 8.8.4.4 UDP:53 open
ok 14 - 8.8.4.4 UDP:53 open

1..14
# tests 14
# pass 14
# fail 0

[2018-02-02T16:06:49.129+0000] ./netassert: localhost pass
```

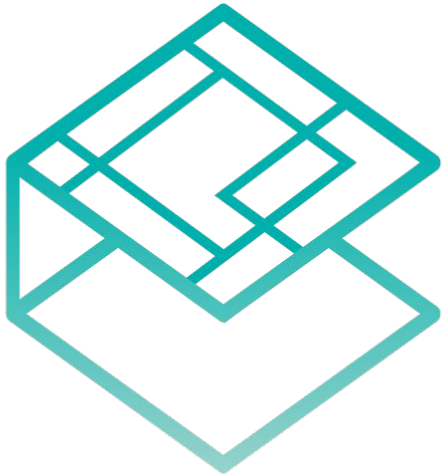
@sublimino

controlplane

Cloud Native Dynamic Firewalls

- Network Policy recipes - https://github.com/ahmetb/kubernetes-network-policy-recipes
- WeaveNet Network Policy - https://kubernetes.io/docs/tasks/administer-cluster/weave-network-policy/
- NeuVector Container Firewall - https://neuvector.com/products/
- Tesla Compromise mitigation - https://www.tigera.io/tesla-compromise-network-policy/

Applications: CNI and Network Policy



CNI

Applications: CNI and Network Policy

Provider	Network Model	Route Distribution	Network Policies	Mesh	External Datastore	Encryption	Ingress/Egress Policies	Commercial Support
Calico	Layer 3	Yes	Yes	Yes	Etcd [1]	Yes	Yes	Yes
Canal	Layer 2 vxlan	N/A	Yes	No	Etcd [1]	No	Yes	No
flannel	vxlan	No	No	No	None	No	No	No
kopeio-networking	Layer 2 vxlan [2]	N/A	No	No	None	Yes [3]	No	No
kube-router	Layer 3	BGP	Yes	No	No	No	No	No
romana	Layer 3	OSPF	Yes	No	Etcd	No	Yes	Yes
Weave Net	Layer 2 vxlan [4]	N/A	Yes	Yes	No	Yes	Yes [5]	Yes

@sublimino

Choosing a CNI Provider

controlplane

Bootstrapping identity with SPIFFE

@sublimino

Attestation Example: Kubernetes

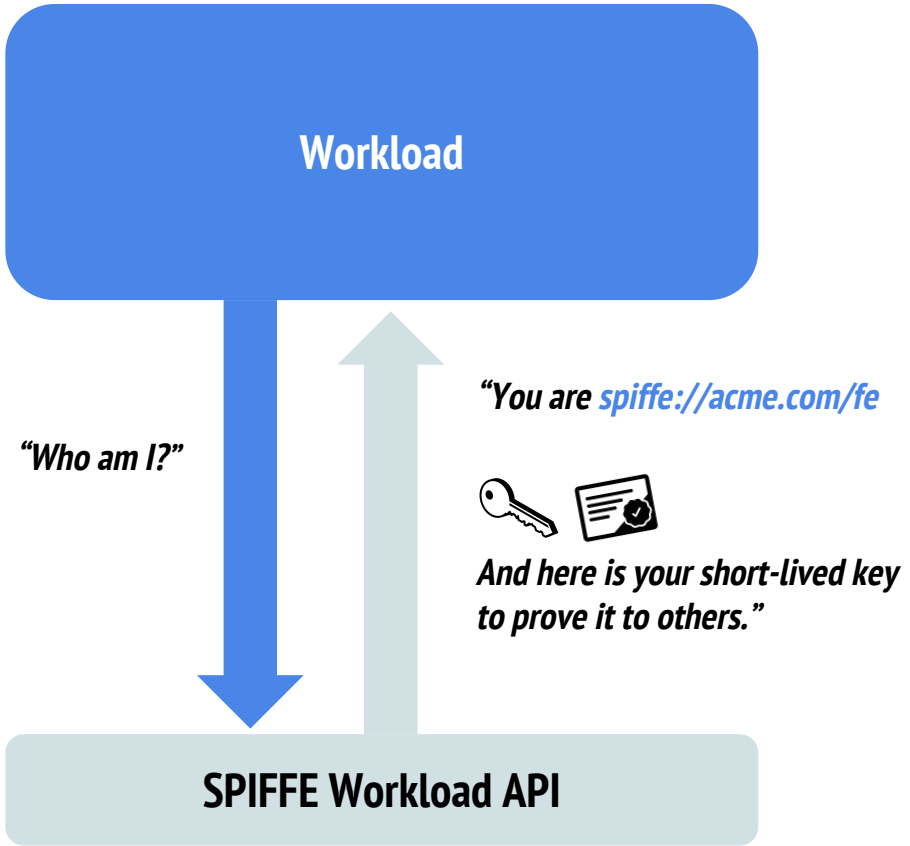
```
/proc/[pid]/cgroup
```


spiffe

SCYTALE

TiGERA

heptio



@sublimino

controlplane

SPIFFE ID

spiffe://acme.com/billing/payments

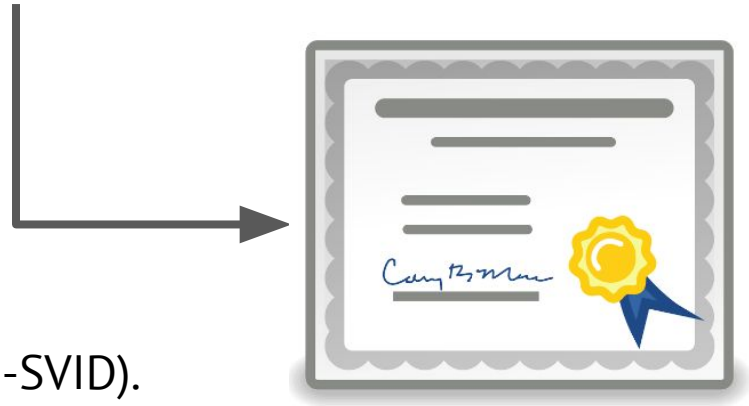
Trust Domain *Workload Identifier*

controlplane

SPIFFE Verifiable Identity Document

spiffe://acme.com/billing/payments

Typically short-lived



Today only one form of SVID (X509-SVID).
Other document types under consideration
(including JWT-SVID)

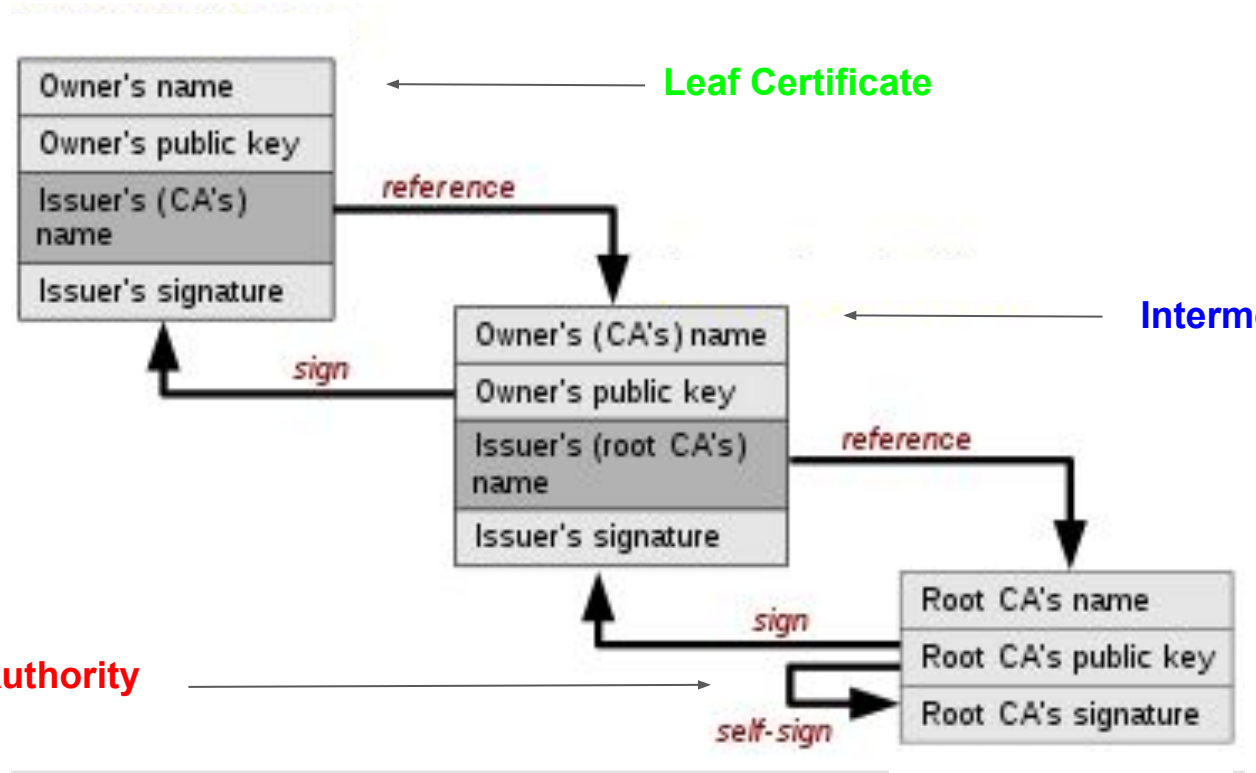
X.509 RFC Format

```
Certificate  ::=  SEQUENCE  {
     tbsCertificate       TBSCertificate,
     signatureAlgorithm   AlgorithmIdentifier,
     signatureValue       BIT STRING  }

TBSCertificate  ::=  SEQUENCE  {
     version         [0]  EXPLICIT Version DEFAULT v1,
     serialNumber         CertificateSerialNumber,
     signature            AlgorithmIdentifier,
     issuer               Name,
     validity             Validity,
     subject              Name,
     subjectPublicKeyInfo SubjectPublicKeyInfo,
     issuerUniqueID  [1]  IMPLICIT UniqueIdentifier OPTIONAL,
                          -- If present, version MUST be v2 or v3
     subjectUniqueID [2]  IMPLICIT UniqueIdentifier OPTIONAL,
                          -- If present, version MUST be v2 or v3
     extensions      [3]  EXPLICIT Extensions OPTIONAL
                          -- If present, version MUST be v3
     }

Version  ::=  INTEGER  {  v1(0), v2(1), v3(2)  }

CertificateSerialNumber  ::=  INTEGER
```

```
Validity ::= SEQUENCE {
     notBefore      Time,
     notAfter       Time }

Time ::= CHOICE {
     utcTime        UTCTime,
     generalTime    GeneralizedTime }

UniqueIdentifier  ::=  BIT STRING

SubjectPublicKeyInfo  ::=  SEQUENCE  {
     algorithm            AlgorithmIdentifier,
     subjectPublicKey     BIT STRING  }

Extensions  ::=  SEQUENCE SIZE (1..MAX) OF Extension

Extension  ::=  SEQUENCE  {
     extnID      OBJECT IDENTIFIER,
     critical    BOOLEAN DEFAULT FALSE,
     extnValue   OCTET STRING
                 -- contains the DER encoding of an ASN.1 value
                 -- corresponding to the extension type identified
                 -- by extnID
     }
```

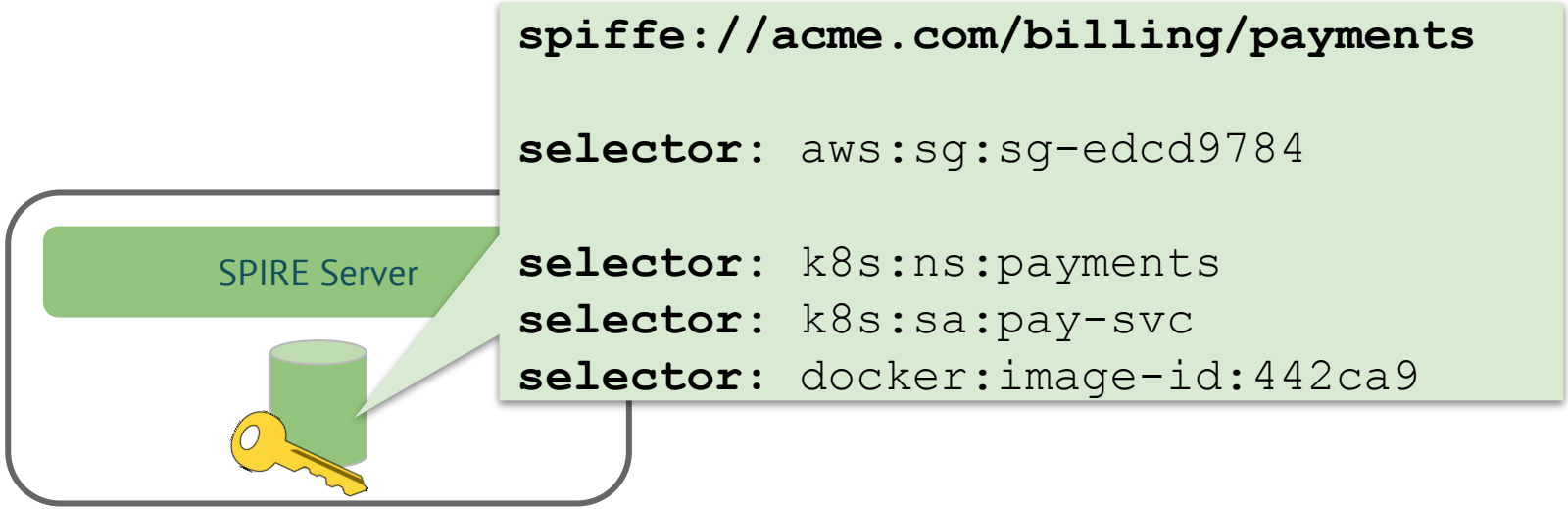
https://github.com/spiffe/spiffe/blob/master/standards/X509-SVID.md#appendix-a-x509-field-reference

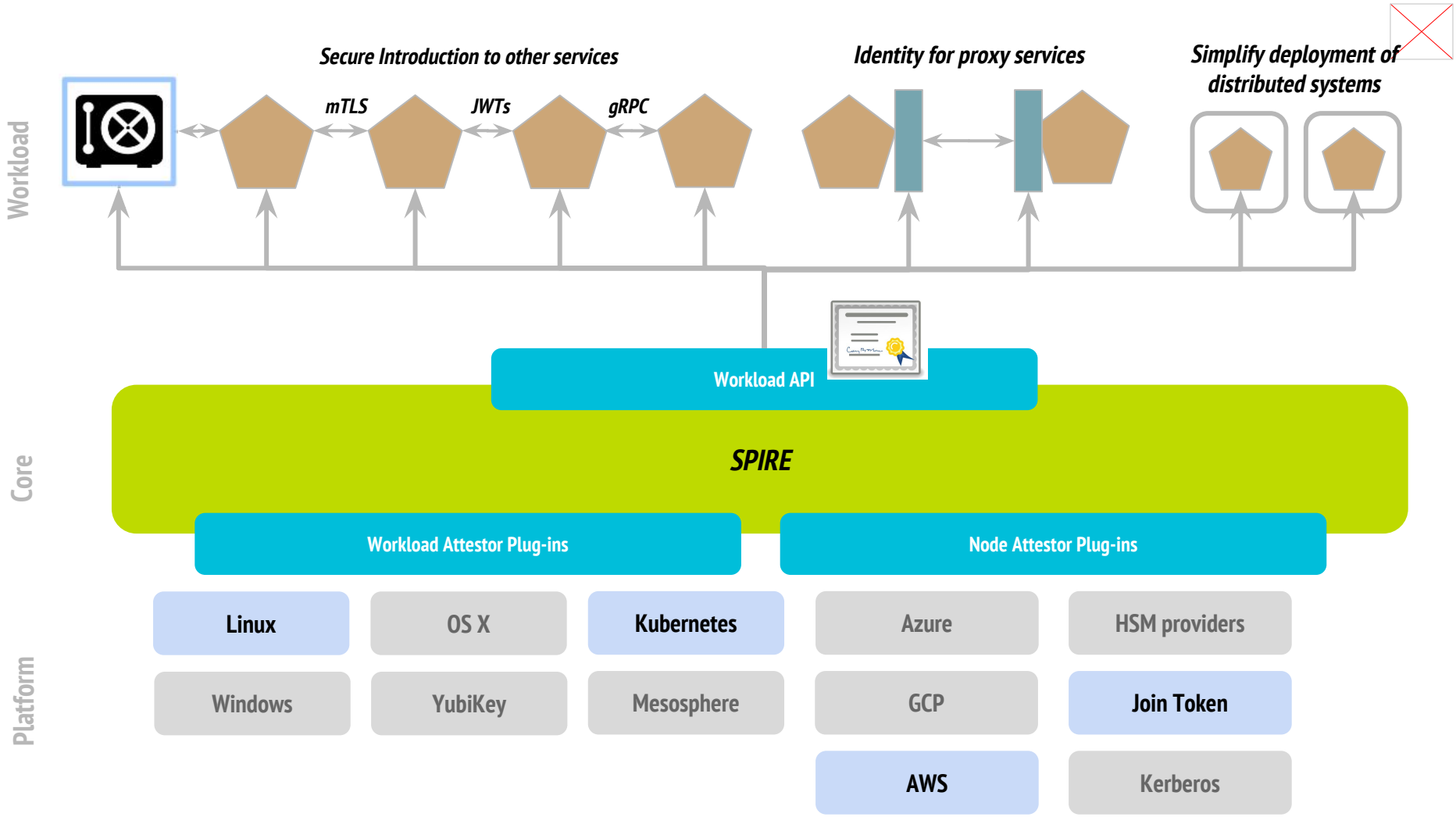
Certificate Path Validation



controlplane

SPIFFE Runtime Environment

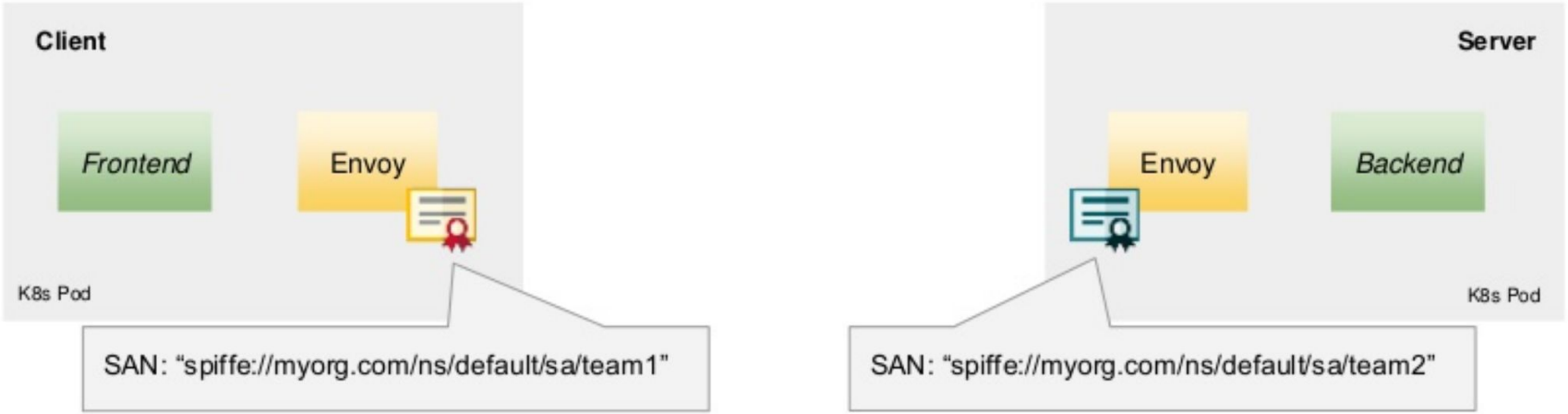



Secure Introduction to other services
Identity for proxy services
Simplify deployment of distributed systems
mTLS
JWTs
gRPC
Workload
Workload API
SPIRE
Core
Workload Attestor Plug-ins
Node Attestor Plug-ins
Linux
OS X
Kubernetes
Azure
HSM providers
Windows
YubiKey
Mesosphere
GCP
Join Token
AWS
Kerberos
Platform

What SPIFFE is *not*

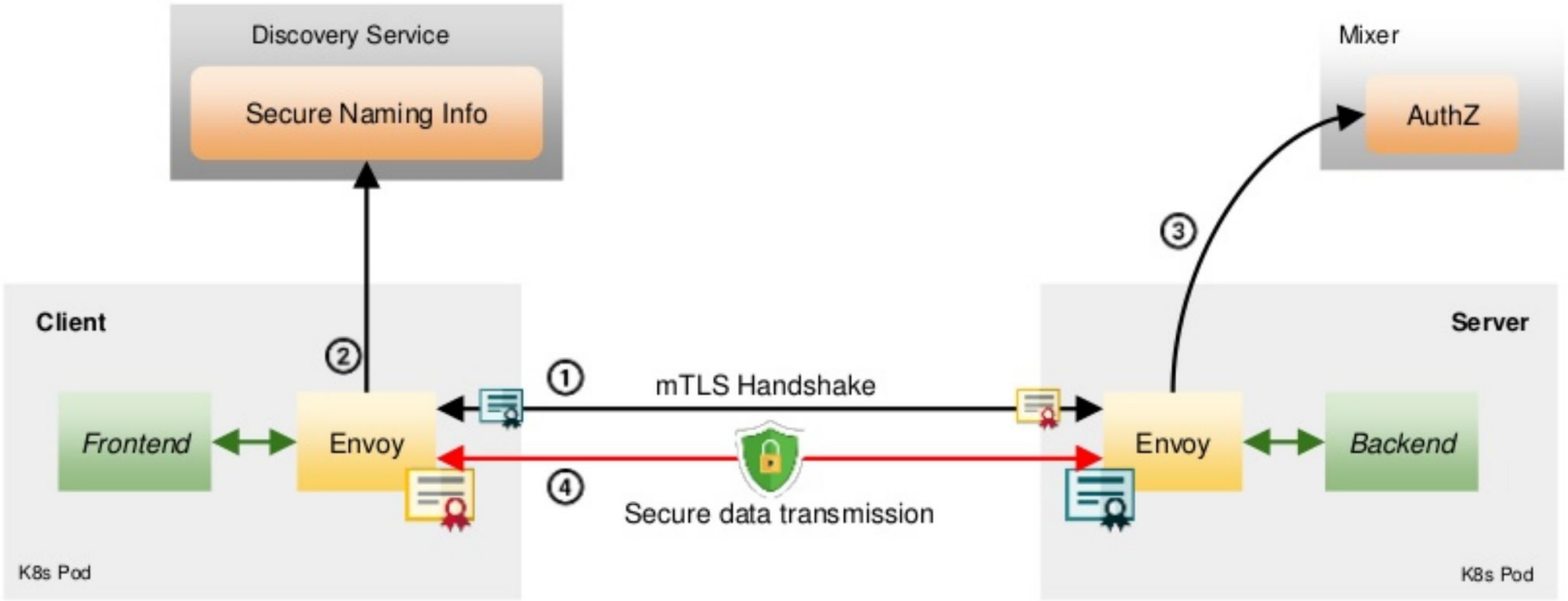
- **Authorization** (however it provides identities upon which authorization schemes can be deployed)
- **Transport level security** (however SVIDs can be used to facilitate things like TLS or JWT signing)

Using SPIFFE in TLS Certificates



- https://www.slideshare.net/MattBaldwin3/istio-cloud-native-online-series-intro-to-istio-security

Istio and SPIFFE



@sublimino

https://www.slideshare.net/MattBaldwin3/istio-cloud-native-online-series-intro-to-istio-security

Recap

controlplane

End to End Encryption

- TLS on API Server Components
- SPIFFE to identify application workloads
- Istio CA to issue TLS certificates to application workloads
- Envoy to proxy application’s HTTPS traffic across the Istio service mesh

Takeaway: Encrypt Everything Everywhere

- Encrypt

Takeaway: Encrypt Everything Everywhere

- Encrypt
- Encrypt Everything

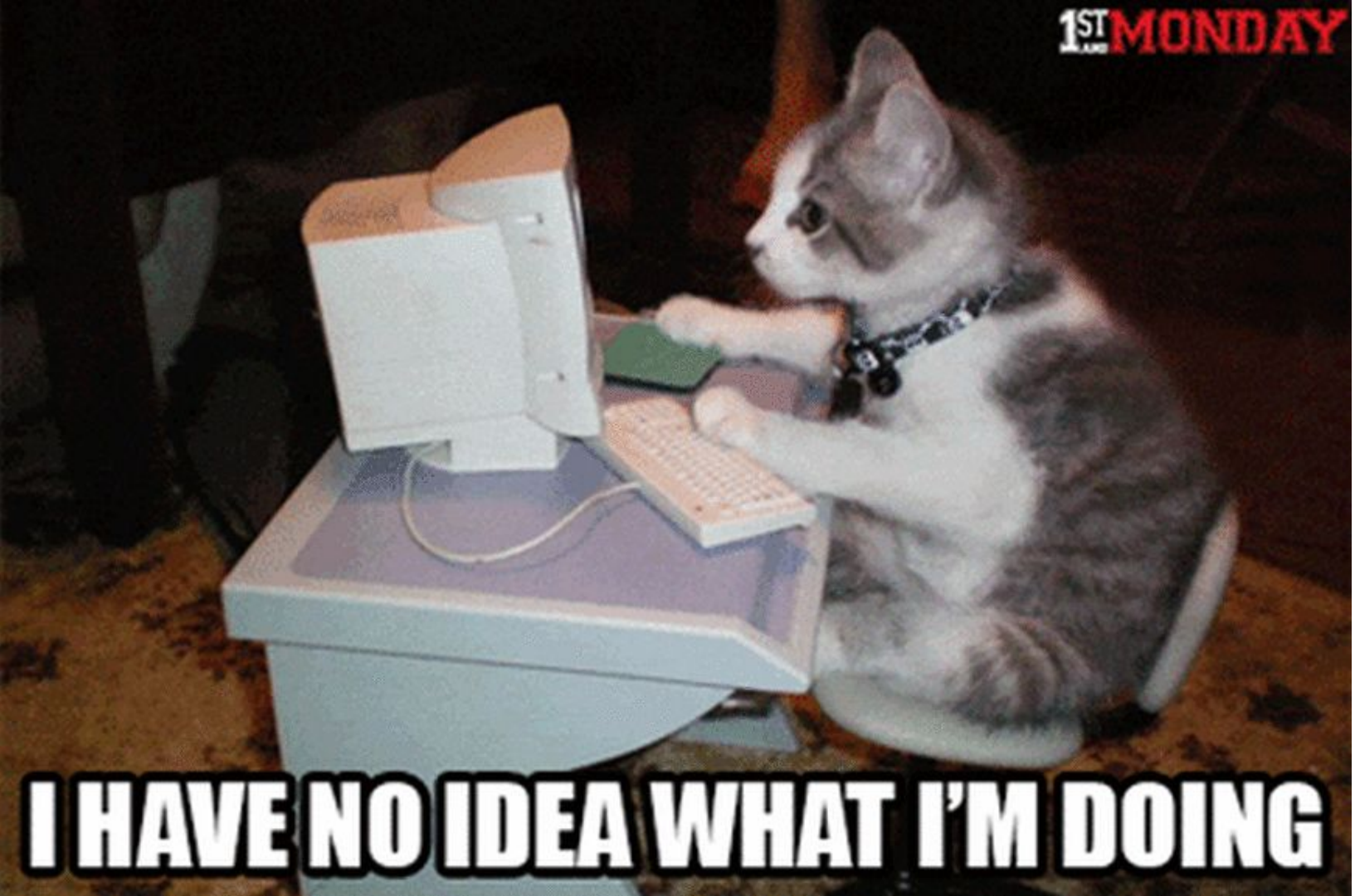
Takeaway: Encrypt Everything Everywhere

- Encrypt
- Encrypt Everything
- Encrypt Everything Everywhere

ALERT: OBLIGATORY HIRING NOTIFICATION

- Hacking cloud native systems (from London)

controlplane



controlplane

OBLIGATORY HIRING NOTIFICATION

- Hacking cloud native systems (from London)
- Working on difficult problems
  - Secure infra and app delivery and provenance
  - Continuous security patterns
  - Supply chain security
  - Third party code risk

HIRING THAT NEW INTERN HAS BEEN A CAT-ASTROPHE.

controlplane

OBLIGATORY HIRING NOTIFICATION

- Hacking cloud native systems (from London)
- Working on difficult problems
  - Secure application delivery and provenance
  - Continuous security patterns
  - Supply chain security
  - Third party code risk
- Good pay, no monoculture, generous benefits, travel
- Engaged minds wanted, on-the-job training
- Infrastructure and build engineers, DevOps, SRE, hackers, security engineers

OBLIGATORY HIRING NOTIFICATION

- Hacking cloud native systems (from London)
- Working on difficult problems
  - Secure application delivery and provenance
  - Continuous security patterns
  - Supply chain security
  - Third party code risk
- Good pay, no monoculture, generous benefits, travel
- Only prereq is an engaged mind
- Infrastructure engineers, DevOps, SRE, hackers, security engineers

Conclusion

- Network Security is important
- TLS, X.509, and Network Policies keep us safe
- Cloud Native applications have more security primitives than ever before
- Istio and SPIFFE give you wings
- Encrypt Everything Everywhere