Critical Stack

ADDRESSING SSL/TLS RISKS
WITH BRO

Presented by
Liam Randall

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PUBLIC SSL/TLS EXPLOITS

A failing web of trust…

Comodo

Adobe
APSA12-01

Microsoft
Flame

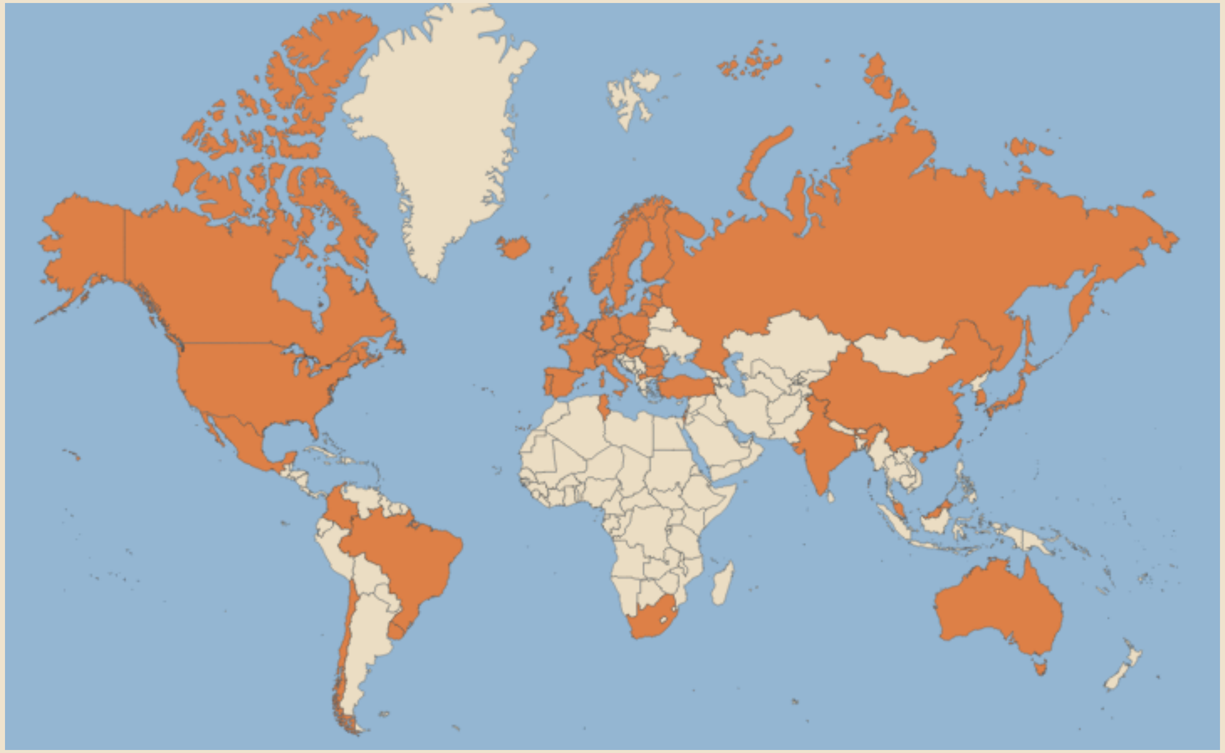
Fortigate
CVE-2012-4948

Cyberoam
CVE-2012-3372

DigiNotar

JURISDICTIONAL RISK

Distribution



Certificate Authority Entities

- 651 CA Organizations
- 52 Jurisdictions (Countries)
  - Many other Sub-CA

['AE', 'AT', 'AU', 'BE', 'BG', 'BM', 'BR', 'CA', 'CH', 'CL', 'CN', 'CO', 'CZ', 'DE', 'DK', 'EE', 'ES', 'EU', 'FI', 'FR', 'GB', 'HK', 'HU', 'IE', 'IL', 'IN', 'IS', 'IT', 'JP', 'KR', 'LT', 'LV', 'MK', 'MO','MX', 'MY', 'NL', 'NO', 'PL', 'PT', 'RO', 'RU', 'SE', 'SG', 'SI', 'SK', 'TN', 'TR', 'TW', 'UK', 'US', 'UY', 'WW', 'ZA']

Compiled by EFF SSL Observatory

PUBLIC SSL/TLS EXPLOITS

All 651 CA's can sign *everywhere* for *anything*.

The compromised companies are not the final target.

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DigiNotar

NIST WARNING

ITL BULLETIN FOR JULY 2012

Preparing for and Responding to Certification Authority Compromise and Fraudulent Certificate Issuance

Paul Turner, Venafi

William Polk, Computer Security Division, Information Technology Laboratory, National Institute of Standards and Technology, U.S. Department of Commerce

Elaine Barker, Computer Security Division, Information Technology Laboratory, National Institute of Standards and Technology, U.S. Department of Commerce

1. Executive Summary

As the use of Public Key Infrastructure (PKI) and digital certificates (e.g., the use of Transport Layer Security [TLS] and Secure Sockets Layer [SSL]) for the security of systems has increased, the certification authorities (CAs) that issue certificates have increasingly become targets for sophisticated cyber-attacks. In 2011, several public certification authorities were attacked, and at least two attacks resulted in the successful issuance of fraudulent certificates by the attackers. An attacker who breaches a CA to generate and obtain fraudulent certificates does so to launch further attacks against other organizations or individuals. An attacker can also use fraudulent certificates to authenticate as another individual or system or to forge digital signatures.

These recent attacks on CAs make it imperative that organizations ensure they are using secure CAs and must also be prepared to respond to a CA compromise or issuance of a fraudulent certificate. Responding to a CA compromise may require replacing all user or device certificates or trust anchors.[1] If an organization is not prepared with an inventory of certificate locations and owners, the organization will not be able to respond in a timely manner and may experience significant interruption in its operations for an extended period of time. This document provides an overview of CA compromise and fraudulent certificate issuance scenarios and recommends steps for preparing for and responding to these incidents.

Many organizations have certificates issued from an external CA, and some organizations operate their own CAs. Nearly all organizations have users and/or systems that establish security using certificates belonging to the parties with whom they communicate. Since many of today's applications are sold with installed trust anchors that users may not be aware of or

[1] Relying parties use root certificates, referred to as trust anchors in this document, that they store locally to verify certificates they receive.

CA Compromises

"An attacker who breaches a CA to generate and obtain fraudulent certificates does so

to launch further attacks against other organizations or individuals."

http://csrc.nist.gov/publications/nistbul/july-2012_itl-bulletin.pdf

A TALE OF TWO CERT(IES)

When both valid, which CERT to Trust?

```
-----BEGIN CERTIFICATE-----
MIIDgDCCAumgAwIBAgIKGI35CwAAAAB4CzANBgkqhkiG9w0BAQUFADBGMQswCQYD
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-----END CERTIFICATE-----
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-----BEGIN CERTIFICATE-----
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```

BRO NETWORK SECURITY MONITOR

A TALE OF TWO CERT(IES)

When both valid, which CERT to Trust?

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```

WEAK HASH

Known Attacks

- Additional risk Enterprises should control & monitor
- Collision Attacks

```
Risk factor :

Medium / CVSS Base Score : 4.0
(CVSS2#AV:N/AC:H/Au:N/C:P/I:P/A:N)
CVSS Temporal Score : 3.3
(CVSS2#E:F/RL:OF/RC:C)
Public Exploit Available : true
```

Replace Immediately

- MD2
- MD4
- MD5

MITIGATIONS EFFORTS

Well known problem

CMU Perspectives

- Browser Based

Certificate Patrol

- Browser Based
- Notify on Updates

convergence.io

- Browser Based
- Distributed Trust

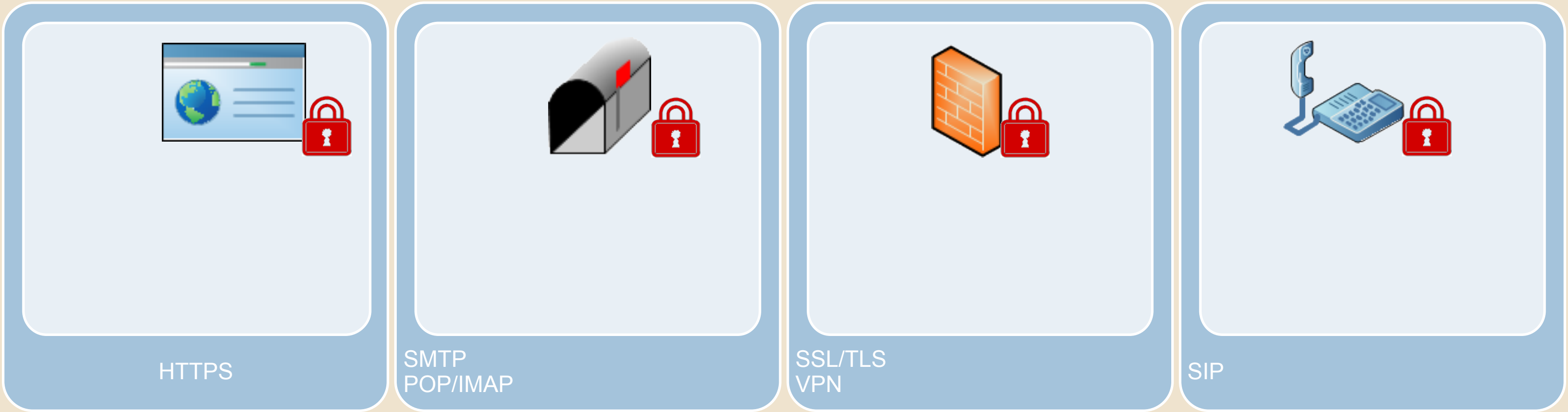
ICSI SSL Notary

- DNS Lookups

AFFECTED SERVICES

Example Use Cases

- + Credit Checks
- + Authorization and Accounting
- + Supply Chain Management
- + e-Commerce
- + Marketing

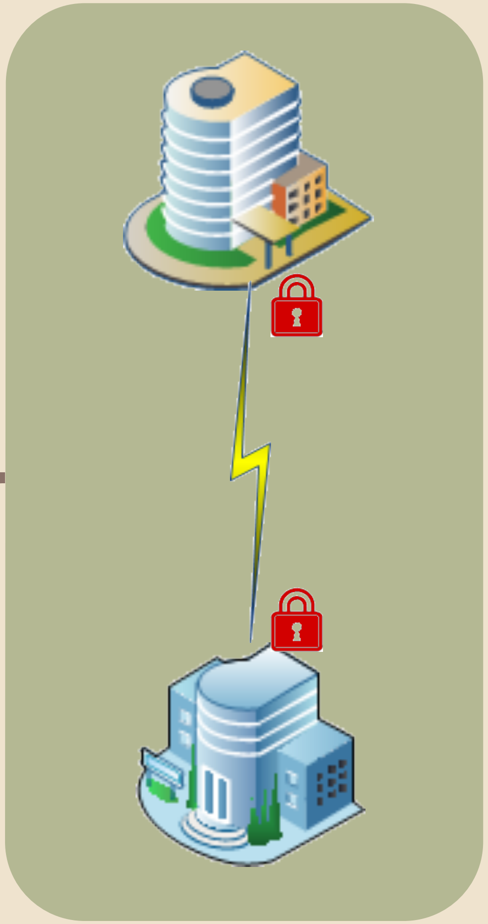


HTTPS

SMTP
POP/IMAP

SSL/TLS
VPN

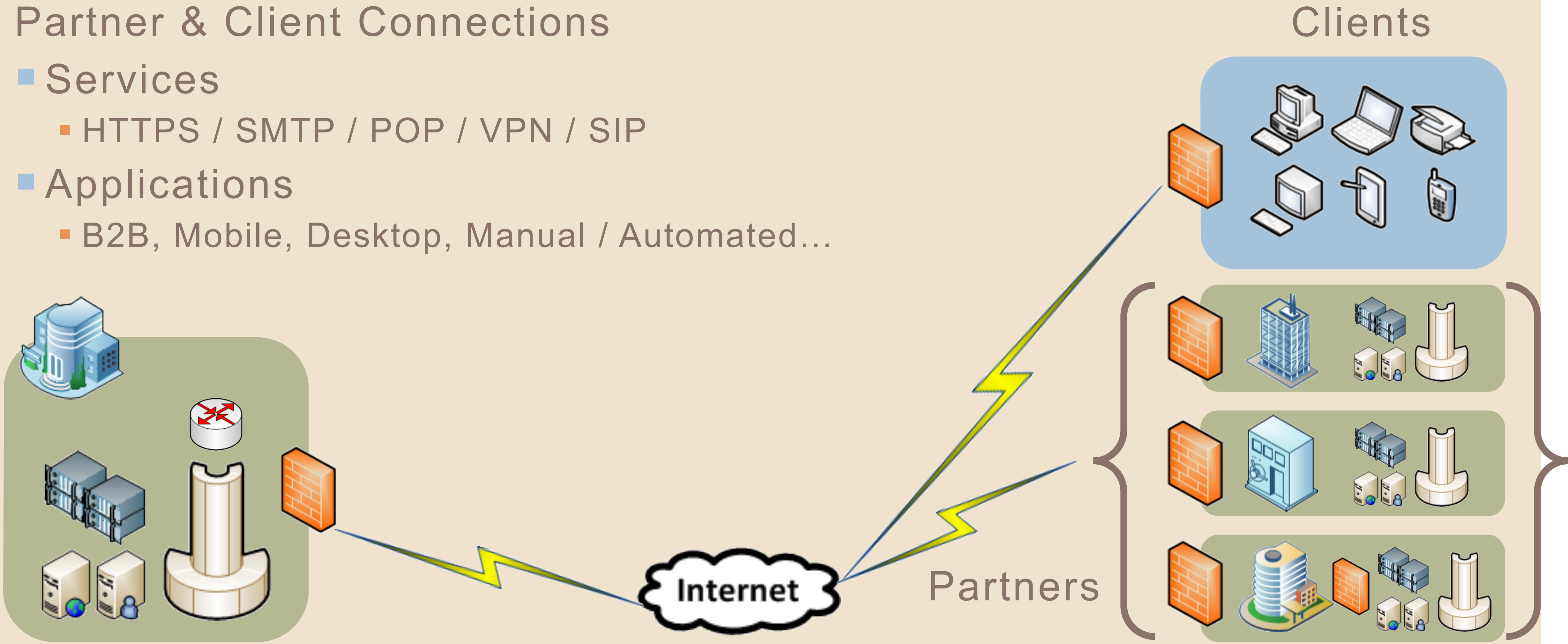
SIP



B2B WHAT SHOULD WE KNOW

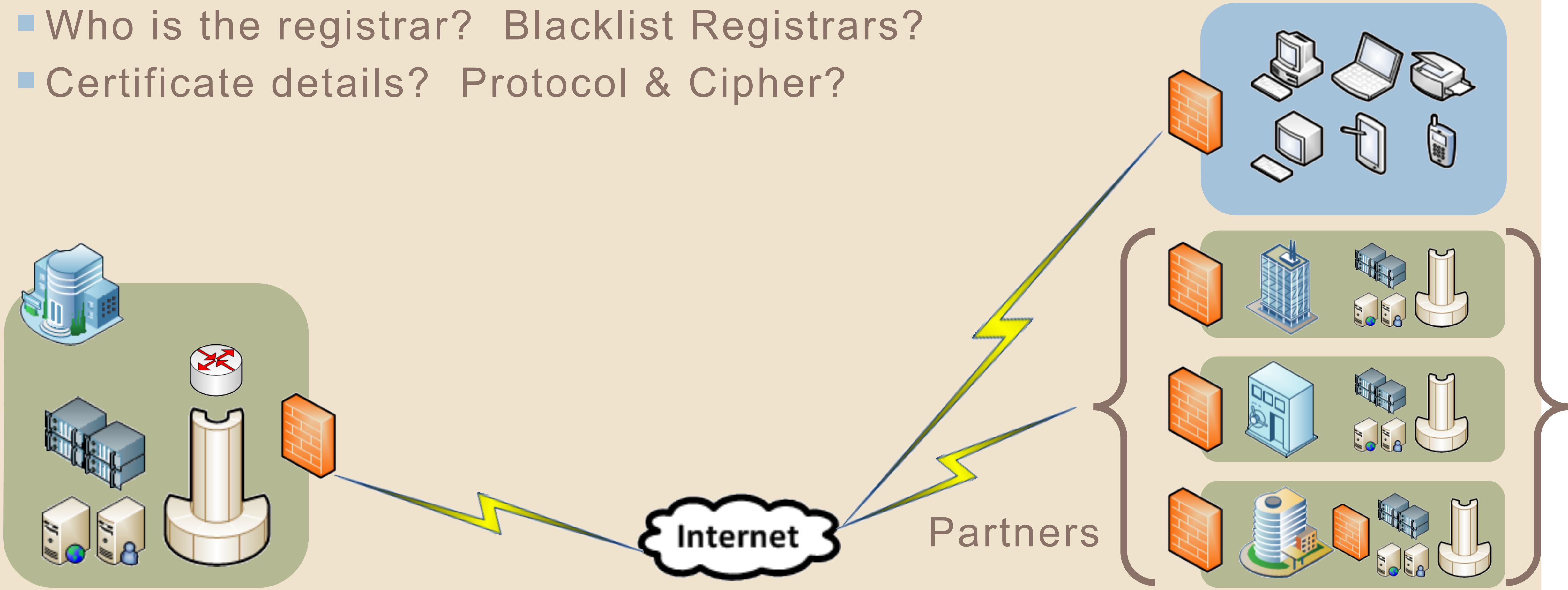
Partner & Client Connections

- Services
  - HTTPS / SMTP / POP / VPN / SIP
- Applications
  - B2B, Mobile, Desktop, Manual / Automated…



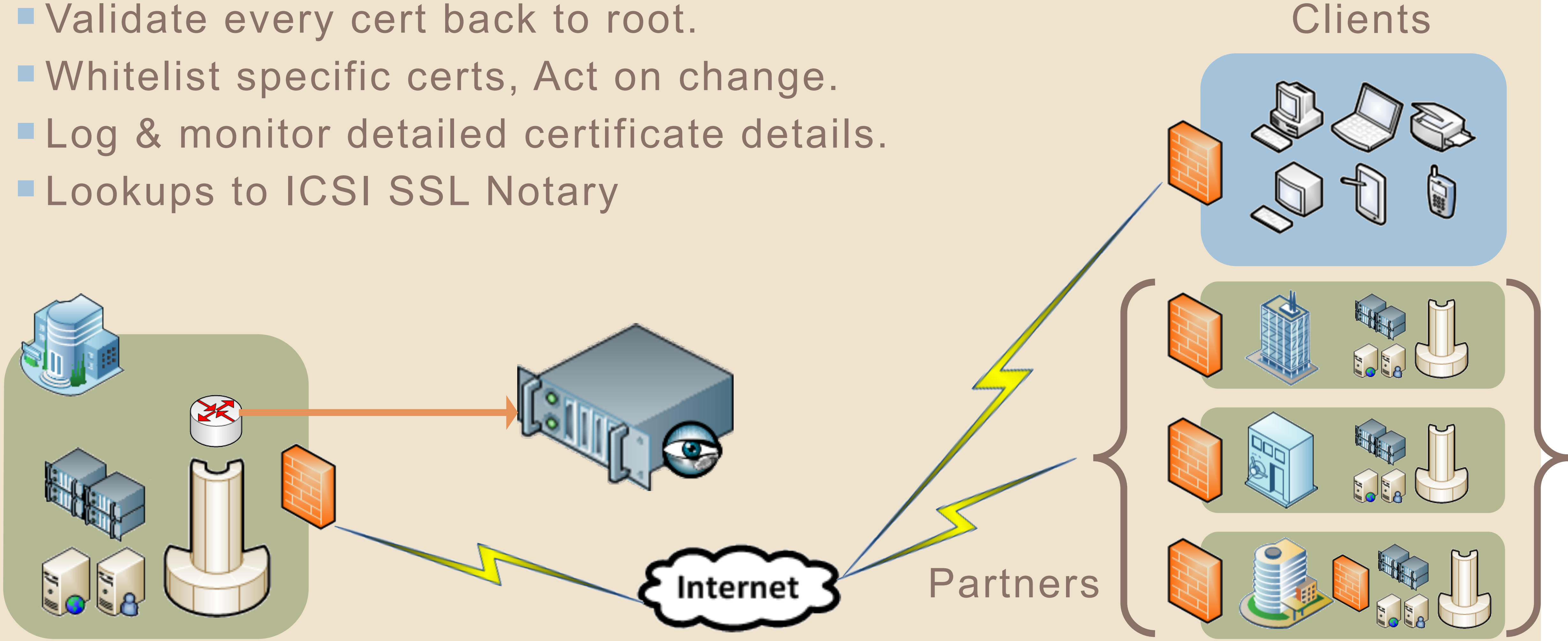
B2B SSL/TLS IOC

- When do certs change? Expire?
- Who is the registrar? Blacklist Registrars?
- Certificate details? Protocol & Cipher?



BRO INSIGHTS

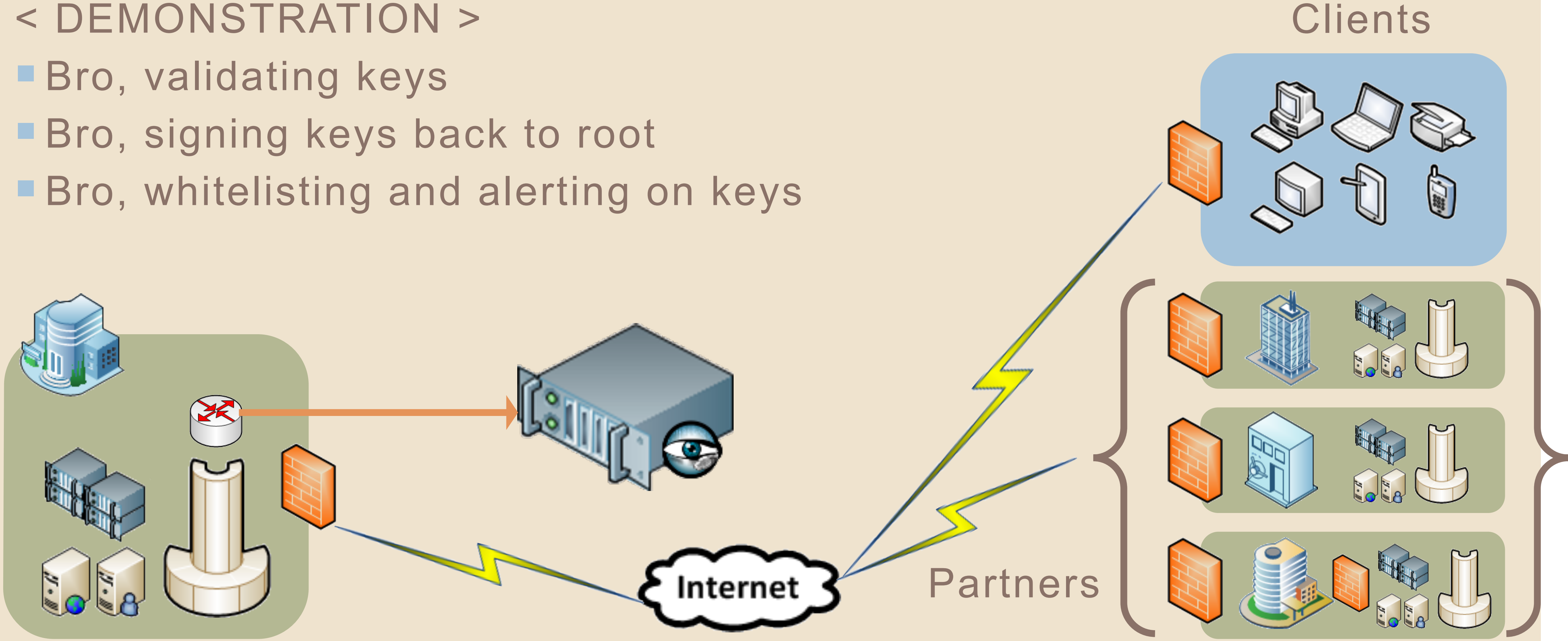
- Validate every cert back to root.
- Whitelist specific certs, Act on change.
- Log & monitor detailed certificate details.
- Lookups to ICSI SSL Notary



BRO INSIGHTS

< DEMONSTRATION >

- Bro, validating keys
- Bro, signing keys back to root
- Bro, whitelisting and alerting on keys


Clients
Internet
Partners