How to...

Render SSL Useless

By Ivan Ristic

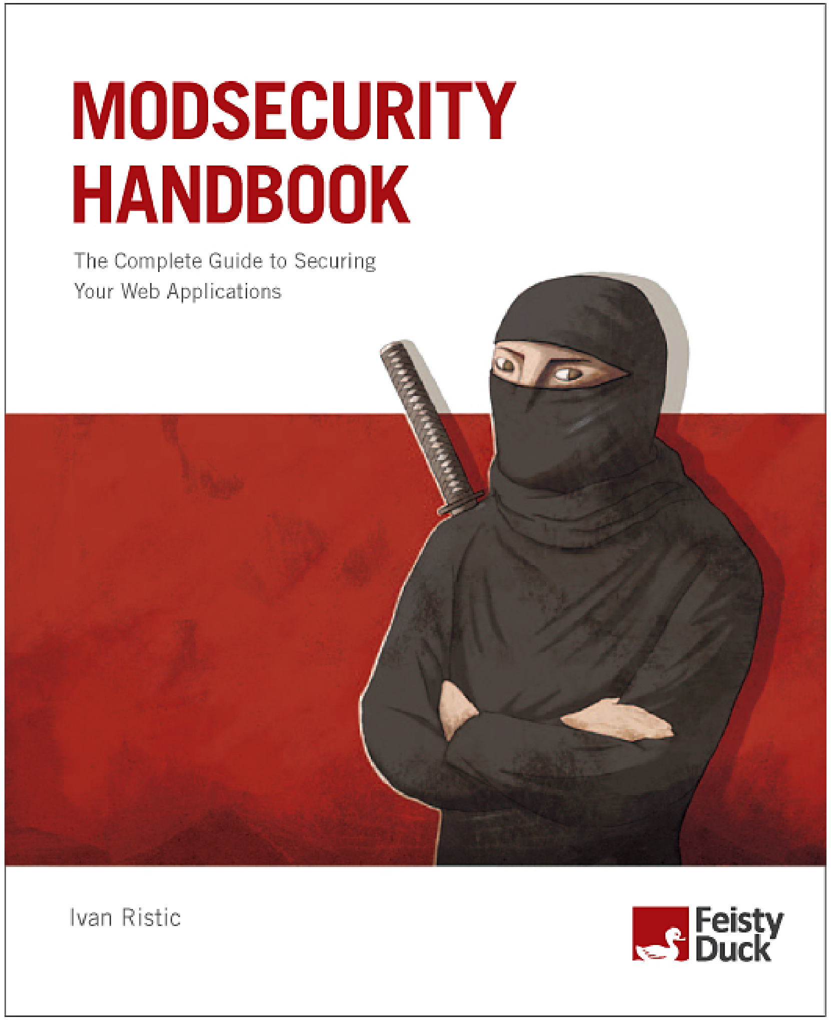
Feisty Duck

Who is Ivan Ristic?

1) *ModSecurity (open source web application firewall),* **2)** *Apache Security (O'Reilly, 2005),* **3)** *SSL Labs (research and assessment platform),* **4)** *ModSecurity Handbook (Feisty Duck, 2010)*

ModSecurity Handbook

Available for pre-order with early access to the digital version.



SSL and TLS

1) Very well designed

2) Very widely used

3) Security backbone of the Internet

4) Secure on its own

5) Easily compromised when used with HTTP

6) Few people pay attention to it

Why was SSL in the news recently?

2008 – MD5 collision and rogue CA generation
(Sotirov et al.)

2009 – NUL byte certificate attacks
(Moxie & Kaminsky separately)

2009 – Authentication Gap
(Marsh Ray)

(And a couple of other, smaller, issues. Did someone mention SSL VPNs?)

Moxie Marlinspike

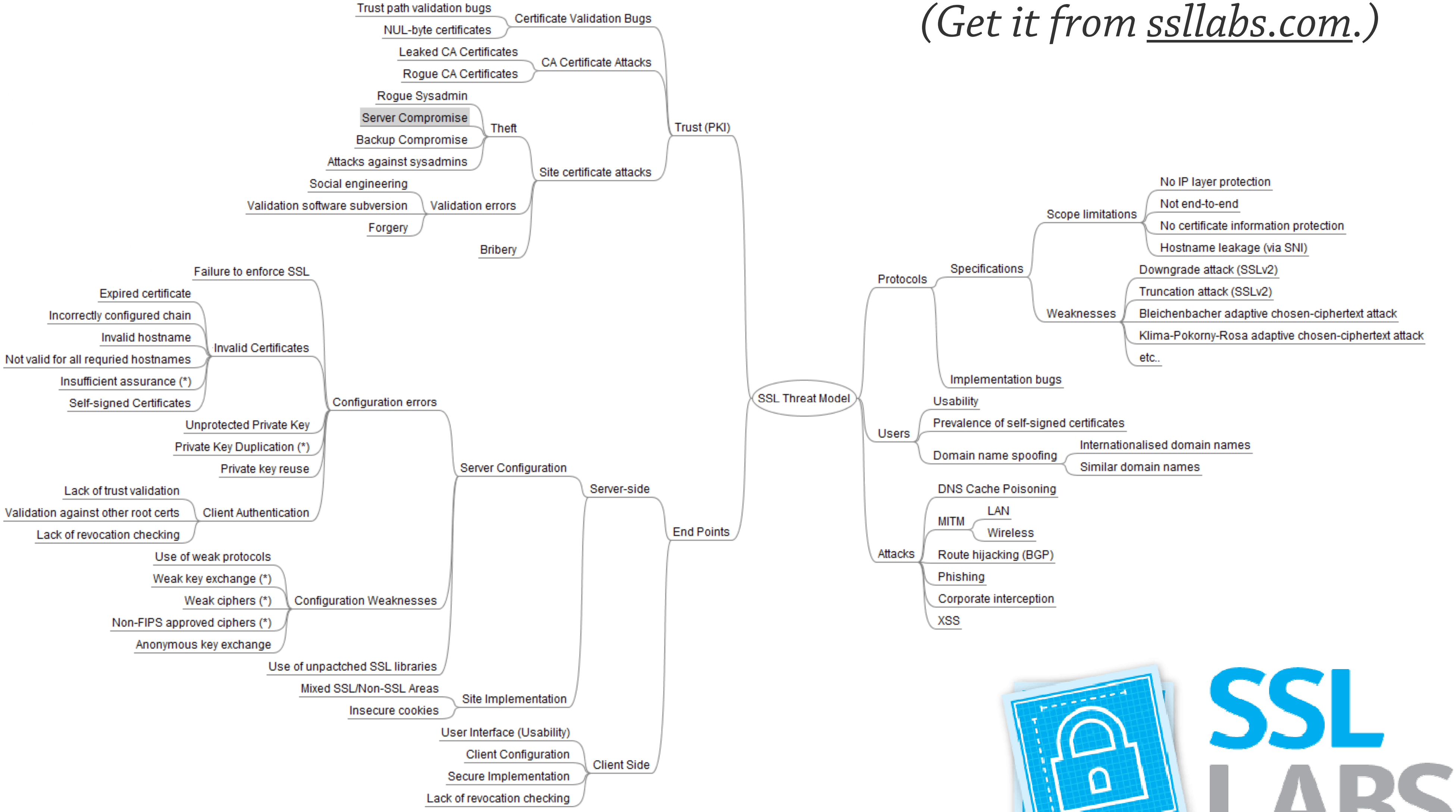
If you need convincing how easy it is to defeat SSL, look for Moxie's ***sslstrip*** *and* ***sslsniff*** *tools.*

Principal Active Threats

- Phishing
- Man-in-the-middle (MITM) attacks
  - Rogue certificates
  - Implementation flaws
  - App and configuration vulnerabilities
- DNS cache poisoning & BGP hijacking
- Domain name hijacking

SSL Threat Model

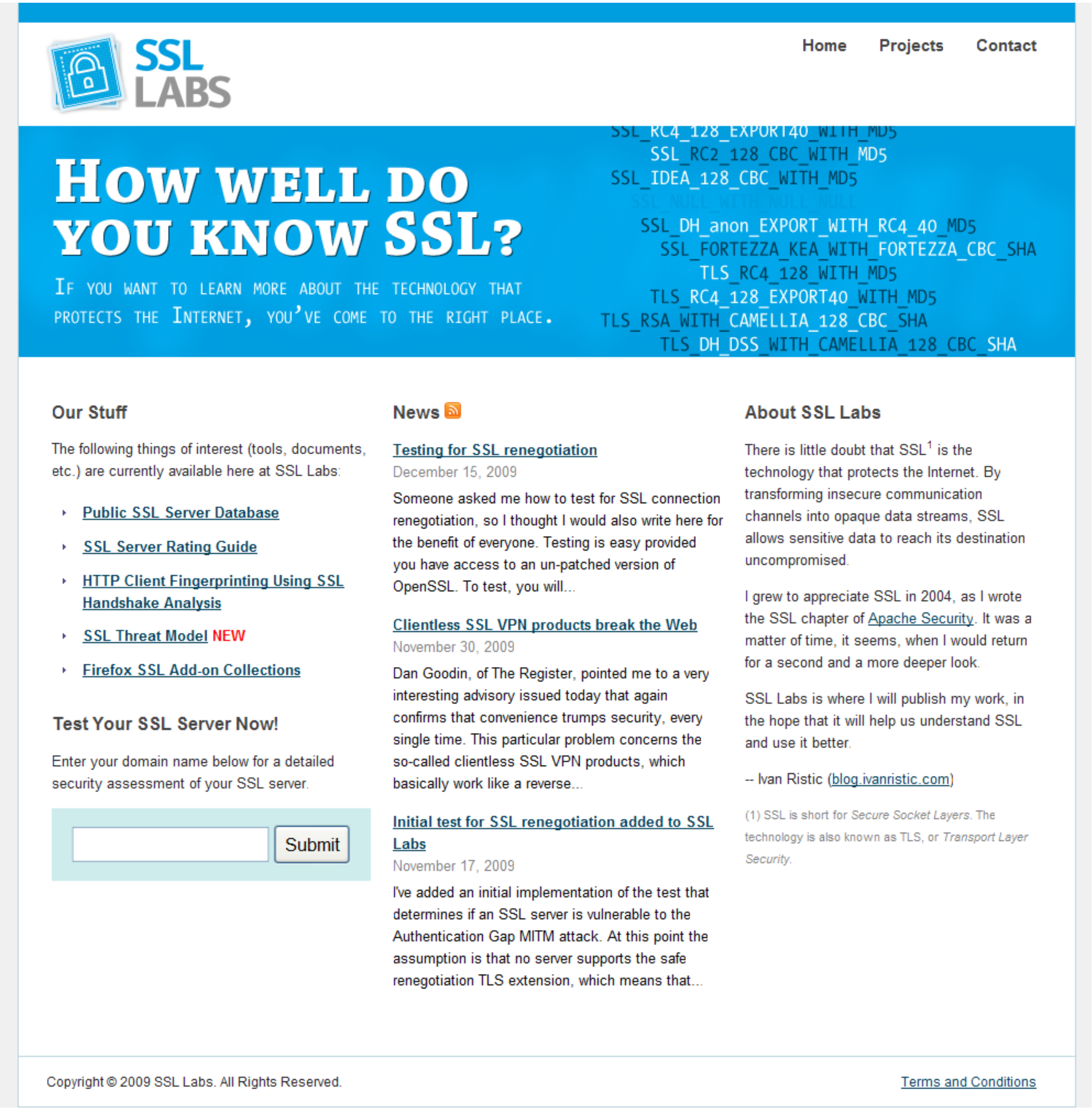
(Get it from ssllabs.com.)



- SSL Threat Model
  - Trust (PKI)
    - Certificate Validation Bugs
      - Trust path validation bugs
      - NUL-byte certificates
    - CA Certificate Attacks
      - Leaked CA Certificates
      - Rogue CA Certificates
    - Site certificate attacks
      - Theft
        - Rogue Sysadmin
        - Server Compromise
        - Backup Compromise
        - Attacks against sysadmins
      - Validation errors
        - Social engineering
        - Validation software subversion
        - Forgery
      - Bribery
  - End Points
    - Server-side
      - Server Configuration
        - Configuration errors
          - Failure to enforce SSL
          - Invalid Certificates
            - Expired certificate
            - Incorrectly configured chain
            - Invalid hostname
            - Not valid for all requried hostnames
            - Insufficient assurance (*)
            - Self-signed Certificates
          - Unprotected Private Key
          - Private Key Duplication (*)
          - Private key reuse
          - Client Authentication
            - Lack of trust validation
            - Validation against other root certs
            - Lack of revocation checking
        - Configuration Weaknesses
          - Use of weak protocols
          - Weak key exchange (*)
          - Weak ciphers (*)
          - Non-FIPS approved ciphers (*)
          - Anonymous key exchange
        - Use of unpatched SSL libraries
      - Site Implementation
        - Mixed SSL/Non-SSL Areas
        - Insecure cookies
    - Client Side
      - User Interface (Usability)
      - Client Configuration
      - Secure Implementation
      - Lack of revocation checking
  - Protocols
    - Specifications
      - Scope limitations
        - No IP layer protection
        - Not end-to-end
        - No certificate information protection
        - Hostname leakage (via SNI)
      - Weaknesses
        - Downgrade attack (SSLv2)
        - Truncation attack (SSLv2)
        - Bleichenbacher adaptive chosen-ciphertext attack
        - Klima-Pokorny-Rosa adaptive chosen-ciphertext attack
        - etc..
    - Implementation bugs
  - Users
    - Usability
    - Prevalence of self-signed certificates
    - Domain name spoofing
      - Internationalised domain names
      - Similar domain names
  - Attacks
    - DNS Cache Poisoning
    - MITM
      - LAN
      - Wireless
    - Route hijacking (BGP)
    - Phishing
    - Corporate interception
    - XSS

SSL Labs

to SSL/TLS research.
Lots of interesting
projects.



How well do you know SSL?

If you want to learn more about the technology that protects the Internet, you've come to the right place.

```
SSL_RC4_128_EXPORT40_WITH_MD5
SSL_RC2_128_CBC_WITH_MD5
SSL_IDEA_128_CBC_WITH_MD5
SSL_NULL_WITH_NULL_NULL
SSL_DH_anon_EXPORT_WITH_RC4_40_MD5
SSL_FORTEZZA_KEA_WITH_FORTEZZA_CBC_SHA
TLS_RC4_128_WITH_MD5
TLS_RC4_128_EXPORT40_WITH_MD5
TLS_RSA_WITH_CAMELLIA_128_CBC_SHA
TLS_DH_DSS_WITH_CAMELLIA_128_CBC_SHA
```

Our Stuff

The following things of interest (tools, documents, etc.) are currently available here at SSL Labs:

- Public SSL Server Database
- SSL Server Rating Guide
- HTTP Client Fingerprinting Using SSL Handshake Analysis
- SSL Threat Model NEW
- Firefox SSL Add-on Collections

Test Your SSL Server Now!

Enter your domain name below for a detailed security assessment of your SSL server.

Submit

News

Testing for SSL renegotiation
December 15, 2009

Someone asked me how to test for SSL connection renegotiation, so I thought I would also write here for the benefit of everyone. Testing is easy provided you have access to an un-patched version of OpenSSL. To test, you will...

Clientless SSL VPN products break the Web
November 30, 2009

Dan Goodin, of The Register, pointed me to a very interesting advisory issued today that again confirms that convenience trumps security, every single time. This particular problem concerns the so-called clientless SSL VPN products, which basically work like a reverse...

Initial test for SSL renegotiation added to SSL Labs
November 17, 2009

I've added an initial implementation of the test that determines if an SSL server is vulnerable to the Authentication Gap MITM attack. At this point the assumption is that no server supports the safe renegotiation TLS extension, which means that...

About SSL Labs

There is little doubt that SSL[1] is the technology that protects the Internet. By transforming insecure communication channels into opaque data streams, SSL allows sensitive data to reach its destination uncompromised.

I grew to appreciate SSL in 2004, as I wrote the SSL chapter of Apache Security. It was a matter of time, it seems, when I would return for a second and a more deeper look.

SSL Labs is where I will publish my work, in the hope that it will help us understand SSL and use it better.

-- Ivan Ristic (blog.ivanristic.com)

(1) SSL is short for *Secure Socket Layers*. The technology is also known as TLS, or *Transport Layer Security*.

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SSL Labs projects

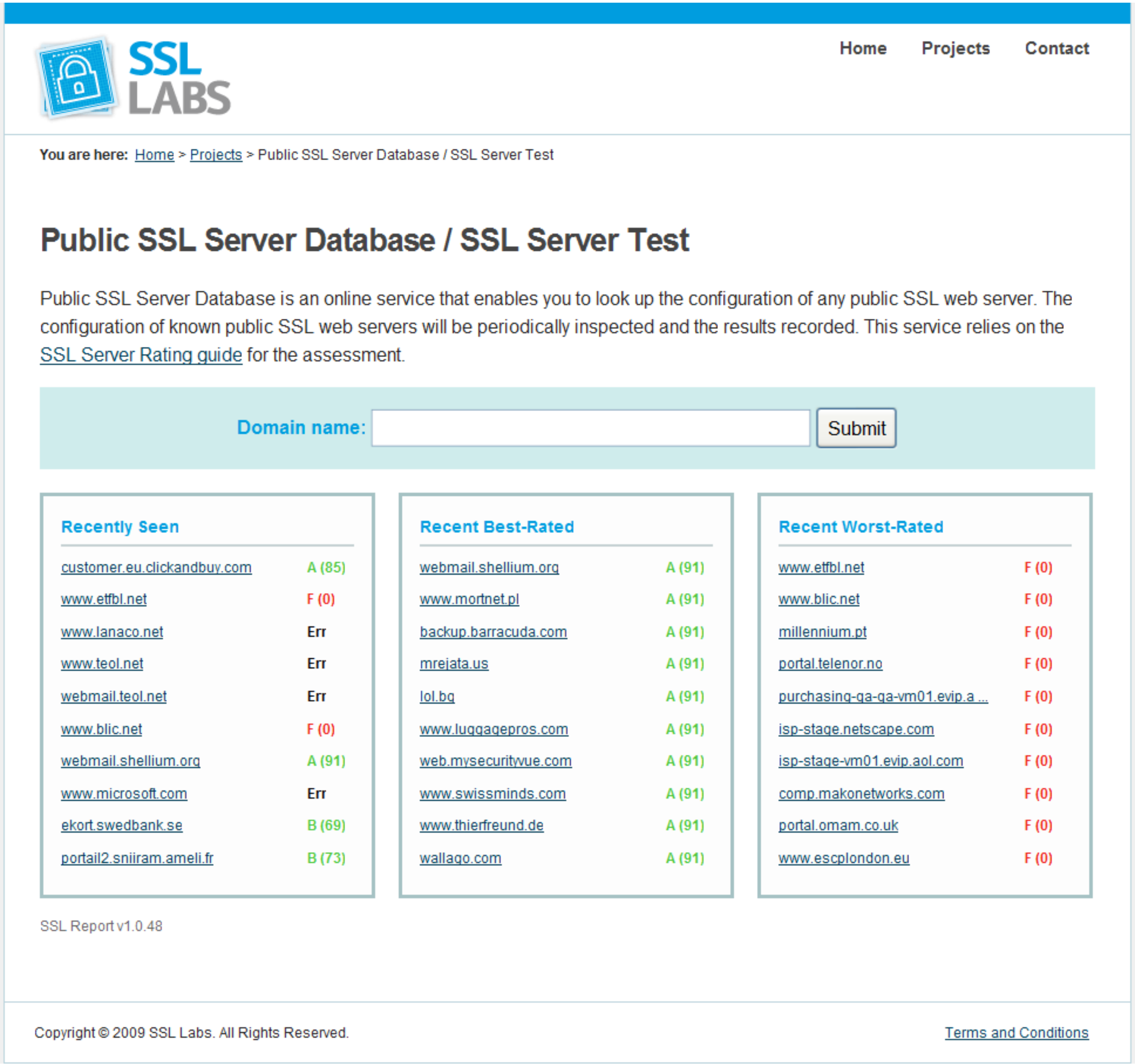
- SSL Server Security Rating Guide
- SSL Server Security Online Assessment
- SSL Threat Model
- Passive SSL Client Fingerprinting tools

Planned:

- SSL Client Capabilities Database
- SSL Usage Tracking
- SSL Server Internet Report

SSL Server Assessment

The most popular part of the site is the free SSL Server Assessment tool.



You are here: Home > Projects > Public SSL Server Database / SSL Server Test

Public SSL Server Database / SSL Server Test

Public SSL Server Database is an online service that enables you to look up the configuration of any public SSL web server. The configuration of known public SSL web servers will be periodically inspected and the results recorded. This service relies on the SSL Server Rating guide for the assessment.

Recently Seen

customer.eu.clickandbuy.com	A (85)
www.etfbl.net	F (0)
www.lanaco.net	Err
www.teol.net	Err
webmail.teol.net	Err
www.blic.net	F (0)
webmail.shellium.org	A (91)
www.microsoft.com	Err
ekort.swedbank.se	B (69)
portail2.sniiram.ameli.fr	B (73)

Recent Best-Rated

webmail.shellium.org	A (91)
www.mortnet.pl	A (91)
backup.barracuda.com	A (91)
mrejata.us	A (91)
lol.bg	A (91)
www.luggagepros.com	A (91)
web.mysecurityvue.com	A (91)
www.swissminds.com	A (91)
www.thierfreund.de	A (91)
wallago.com	A (91)

Recent Worst-Rated

www.etfbl.net	F (0)
www.blic.net	F (0)
millennium.pt	F (0)
portal.telenor.no	F (0)
purchasing-qa-qa-vm01.evip.a ...	F (0)
isp-stage.netscape.com	F (0)
isp-stage-vm01.evip.aol.com	F (0)
comp.makonetworks.com	F (0)
portal.omam.co.uk	F (0)
www.escplondon.eu	F (0)

SSL Report v1.0.48

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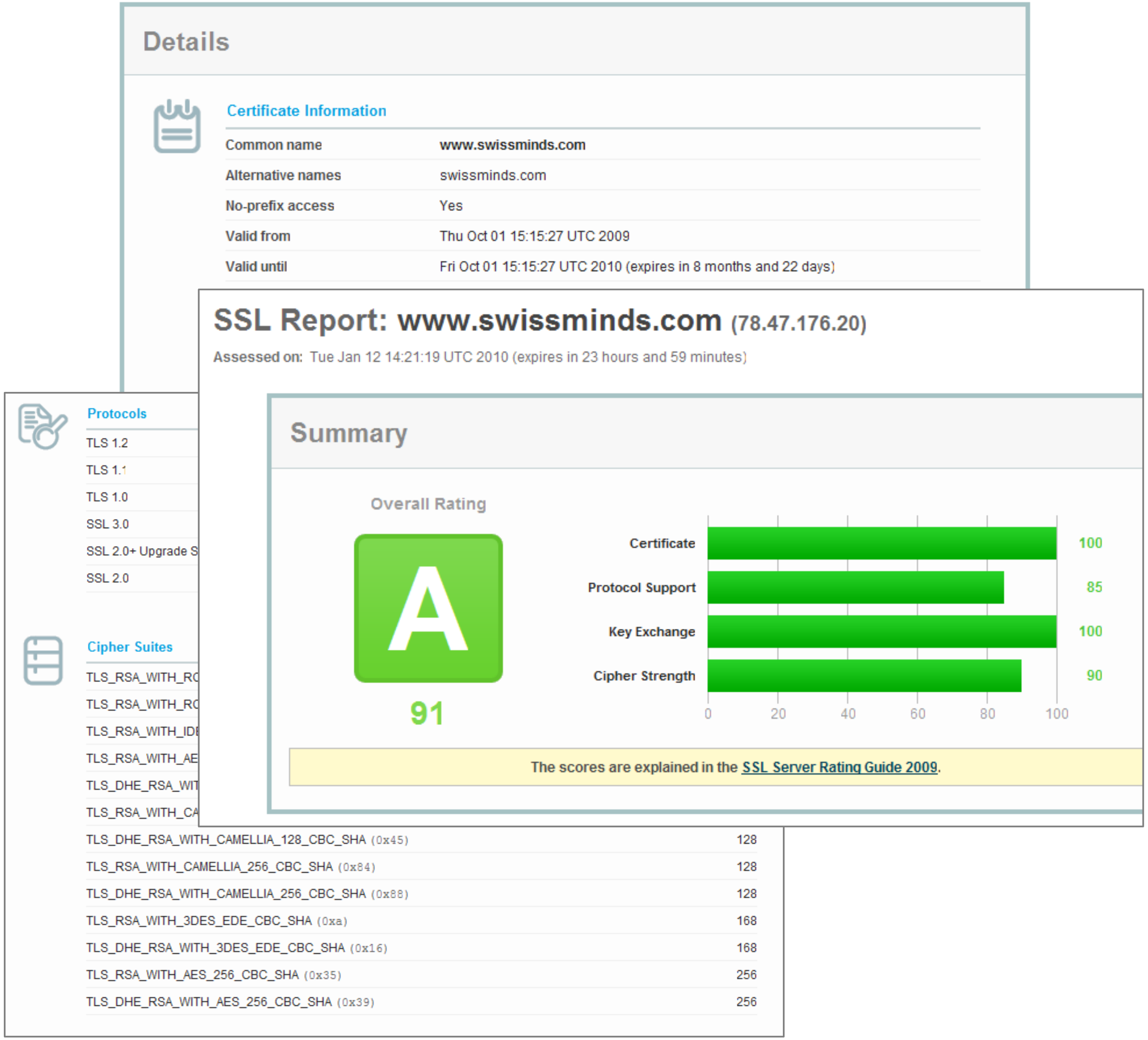
SSL Server Assessment

The most comprehensive assessment product available anywhere.



Details

Certificate Information

Common name	**www.swissminds.com**
Alternative names	swissminds.com
No-prefix access	Yes
Valid from	Thu Oct 01 15:15:27 UTC 2009
Valid until	Fri Oct 01 15:15:27 UTC 2010 (expires in 8 months and 22 days)

Protocols

- TLS 1.2
- TLS 1.1
- TLS 1.0
- SSL 3.0
- SSL 2.0+ Upgrade S
- SSL 2.0

Cipher Suites

TLS_RSA_WITH_RC	
TLS_RSA_WITH_RC	
TLS_RSA_WITH_IDE	
TLS_RSA_WITH_AE	
TLS_DHE_RSA_WIT	
TLS_RSA_WITH_CA	
TLS_DHE_RSA_WITH_CAMELLIA_128_CBC_SHA (0x45)	128
TLS_RSA_WITH_CAMELLIA_256_CBC_SHA (0x84)	128
TLS_DHE_RSA_WITH_CAMELLIA_256_CBC_SHA (0x88)	128
TLS_RSA_WITH_3DES_EDE_CBC_SHA (0xa)	168
TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA (0x16)	168
TLS_RSA_WITH_AES_256_CBC_SHA (0x35)	256
TLS_DHE_RSA_WITH_AES_256_CBC_SHA (0x39)	256

SSL Report: www.swissminds.com (78.47.176.20)

Assessed on: Tue Jan 12 14:21:19 UTC 2010 (expires in 23 hours and 59 minutes)

Summary

Overall Rating

A

91

Certificate	100
Protocol Support	85
Key Exchange	100
Cipher Strength	90

The scores are explained in the SSL Server Rating Guide 2009.

Feature Presentation

SSL Deployment Mistakes

1 Self-signed certificates

- Self-signed certificates are spoiling SSL security for all of us
- They are insecure
- We are teaching users to ignore warnings
- Certificates are cheap, or even free
- It's cheaper to buy a certificate than support a self-signed one

2 Own CA certificates

- You configure a web site, don’t want to pay small $ for a proper certificate, but don’t mind spending a lot of time creating a custom CA?!
- Encouraging others to use your CA root is terribly insecure
- How well is your CA root protected?
- Any CA root can sign any site!

3 Mixing SSL and plain-text

- Difficult to implement securely
- You will probably need two session mechanisms, one for each area
- That, and a secure way to transfer users from one to another (i.e., re-authenticate)
- Trivial for the MITM to use *sslstrip* to convert HTTPS links to HTTP

4 Not using secure cookies

- Secure cookies are transmitted only over SSL
- Even if your site does not use plain-text anywhere (and does not even run on port 80), browsers can be tricked into revealing non-secure cookies by a MITM attacker
- You *must* use secure cookies everywhere

5 Using incomplete certificates

- You type *https://sllabs.com* and expect to see the same site as on *https://www.ssllabs.com*
- On many sites you get an SSL warning
- Very confusing for users
- Use a CA that makes certificates that are valid with and without the www prefix

6 Not using EV certificate

- High-value web sites will often be a target of phishing attacks
- It is easy to mistype and end up at the wrong place, even if you are en experienced user
- The green glow helps ensure your users that they are in the *right* place

7 Not using SSL

- There are many sites that do not use SSL but they should
- If there's authentication – it needs SSL
- If there's a form – it needs SSL

8 Mixed page content

- Some browsers will warn on mixed content, some will not
- Depending on the skills of your web designer, a large proportion of your users could be getting warnings
- A single plain-text link is enough to compromise the entire SSL site

9 Different sites on 80 and 443

- You type *https://www.example.com* and expect to see the same site as on *http://www.example.com*
- This is the fate of every single site that uses virtual hosting
- Would you mind if questionable content appeared on *https://www.yourcompany.com*?

10 Using SSL for “important” bits

- Some sites will use SSL to protect authentication and nothing else
- They are vulnerable to session hijacking
- Some even allow users to change password without knowing the old ones

11 Inconsistent DNS configuration

- Your *www.example.com* address points to one web server, while *example.com* points to another
- It surprising how many high-profile sites suffer from this problem
- Similar problem to #5

Core Issues

1) Browsers accept invalid certificates

2) Insufficient security indications

3) Decoupled nature of HTTP and SSL

4) No broad support for virtual SSL hosting

5) Some sites use SSL some don’t

6) The burden of security is on users

Message for today *SSL is a rare application security area where we can make things 100% secure, with relatively small effort.* ***Why not get it right?***

Thank you!

The slides will be available for download
from http://blog.ivanristic.com

Feisty Duck