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How to Make Your Oracle APEX Application Secure

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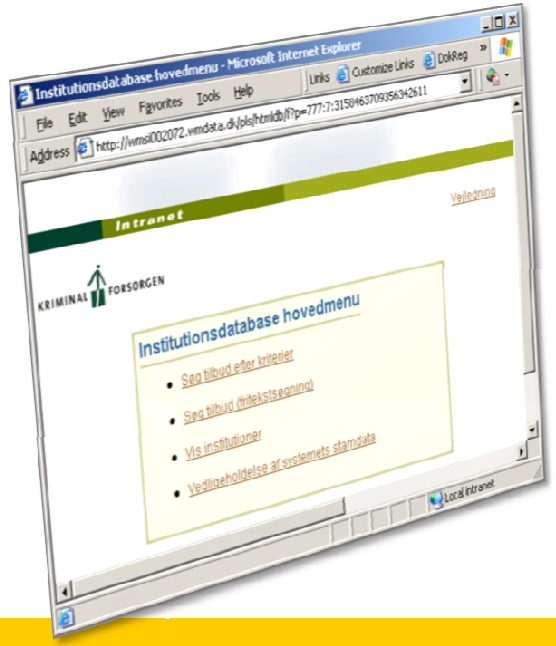
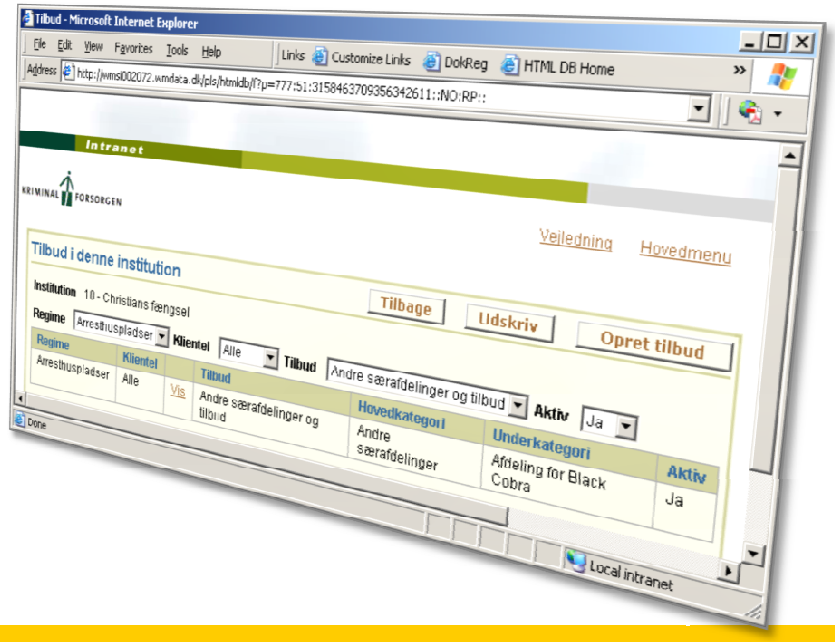
Presentation

- Target audience is **developers**
- Focus is on how to prevent **hackers** from gaining access
- In terms of what I believe an **APEX developer in a small shop**, without a fulltime security expert or DBA, should know
- More an **overview of security threats and countermeasures** than a thorough analysis
- **Point you to resources** with more information about the different subjects
- Assumption: An application that
  - is **accessed from the Internet**
  - contains **valuable and secret information**

APEX Project References

- The Danish Department of Prisons and Probation uses APEX in the process of deciding in which facility a client should serve
- RTX Telecom uses APEX to control DECT cordless telephones in Rumania
- Naturgas Fyn is a provider of natural gas in Denmark. Currently we are developing a system that calculates the amount of gas that is needed from each gas provider the following day





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Agenda

- **Intro**
- **Architecture**
  - HTTP Servers
  - Choosing an Architecture
- **Hardening the Architecture**
  - Patching
  - Hardening the Database
  - Hardening the HTTP Web Server
- **Specific Threats**
  - Cross-Site Scripting
  - SQL Injection
- **Hardening APEX**
  - Miscellaneous
- **Conclusion**

Intro – Security, what security?

A security company estimates that there are a 71% likelihood that a Website has a Cross-Site Scripting vulnerability and 20% for a SQL Injection

- 35 new security fixes for Oracle Application Express, 25 of w
an optional product that is not installed with the Oracle Datab

0-Day exploit

- Computer Emergency Response Team (CERT) say 95% of all intrusions are made using known vulnerabilities
- Deloitte 2005 Global Security Survey said Internal attacks exceed external attacks

Breach of data at TJX is called the biggest ever

The Globe

Stolen numbers put at 45 .7 million

By Jenn Abelson, Globe Staff | March 29, 2007

At least 45.7 million credit and debit card numbers were stolen by hackers who accessed the computer systems at the TJX Cos. at its headquarters in Framingham and in the United Kingdom over a period

Security

Oracle Ships Mega Update for DB, Server Flaws

By Ryan Naraine
October 18, 2006

TalkBack
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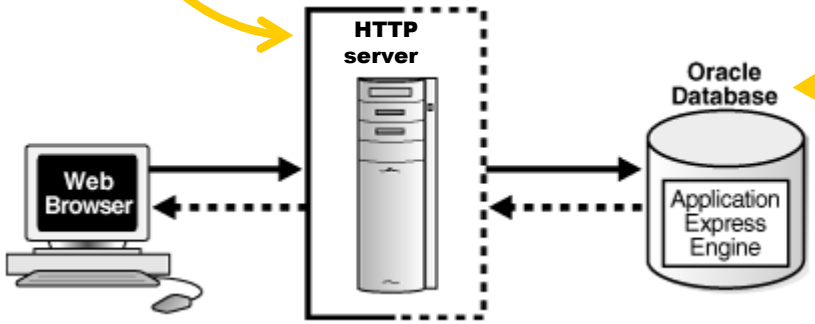
Oracle has shipped a monster critical patch update with fixes for more than 100 security vulnerabilities in a wide range of database and server products.

Architecture

APEX Components

- Oracle HTTP Server (Database Companion CD)
- Oracle HTTP Server (Oracle Application Server)
- Oracle XML DB HTTP Server

- Oracle 9i/10g Database
- ~~Oracle Express Edition~~



There is such a thing as too cheap

Architecture

Which HTTP Server to Use?

	Oracle HTTP Server (OHS) ✓	Oracle XML DB HTTP Server
Technology	Apache 1.3.x	Developed by Oracle. Builds on the Oracle Shared Server architecture
Database “connection”	mod_plsql	Embedded PL/SQL Gateway

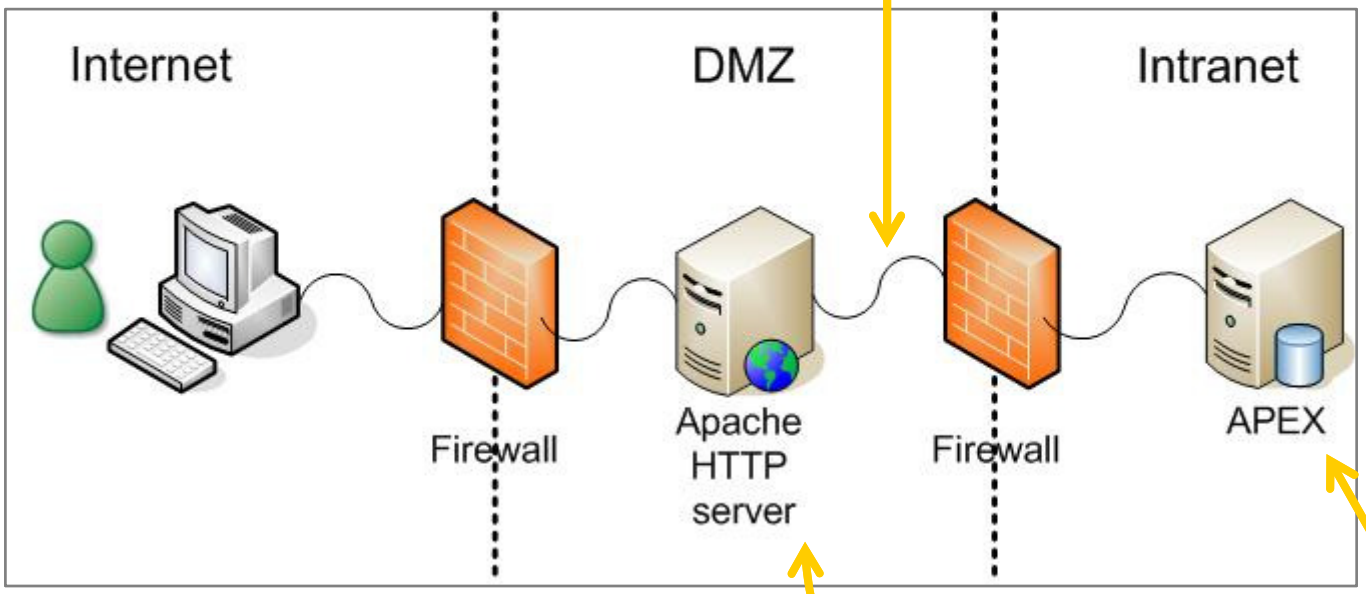
Use known technology

Architecture

"Security is an architecture, not an appliance" - Art Wittman

Minimum

Only HTTP communication



Proxy HTTP Servers

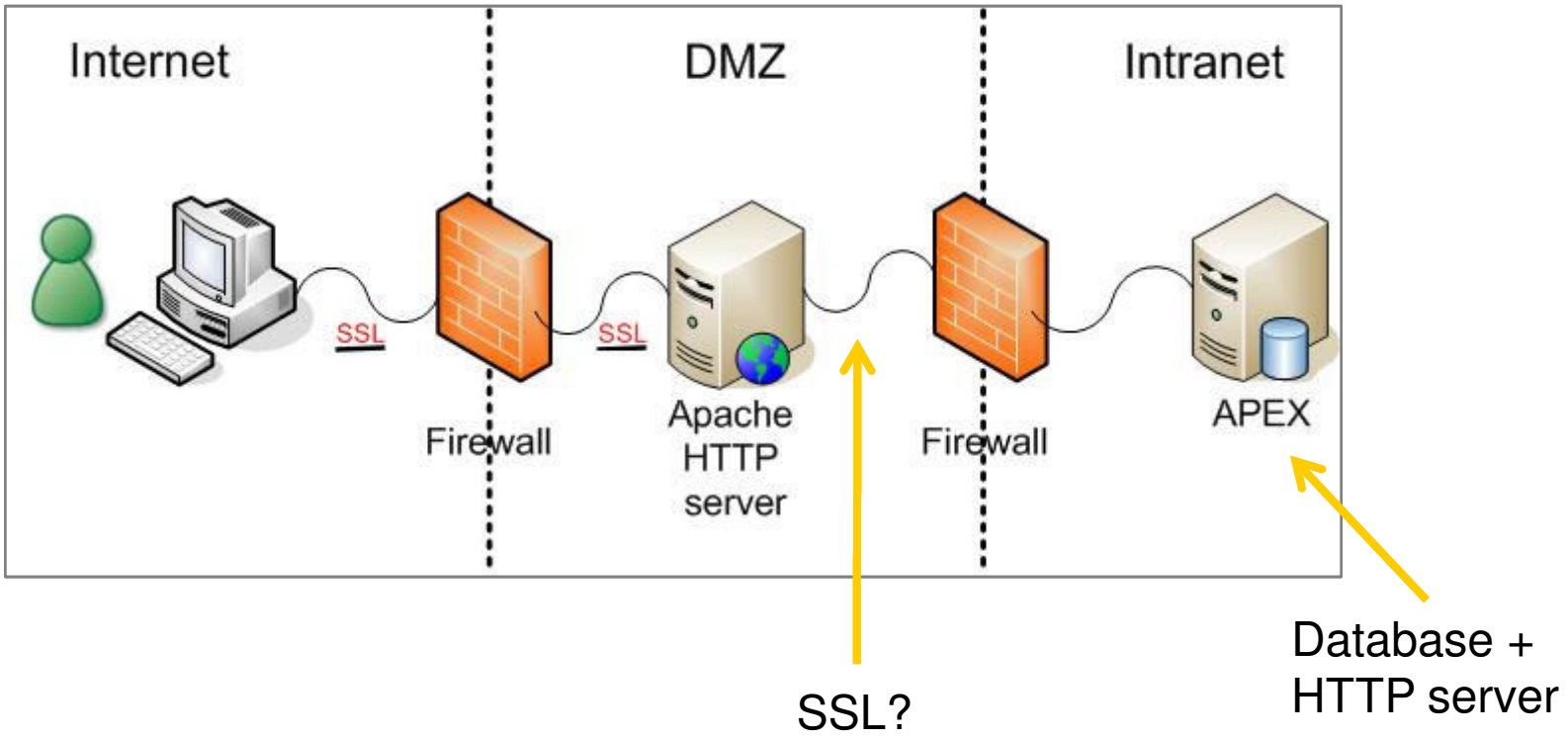
- Standard Apache 1.3/2.0 HTTP Server
- OHS based on an Apache 2.0.x HTTP Server

mod_proxy

Database +
HTTP server

Architecture

Using Secure Sockets Layer (SSL) encryption



Security measures should match the risk and the value of the secured application/data

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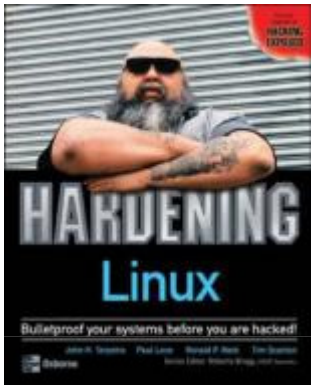
Hardening the Architecture

- Patch, Patch, Patch
  - Critical Patch Update (CPU)
  - Oracle Security Alerts
  - Remember regular Patch Sets
  - The Oracle HTTP Server – Patches from Oracle
  - Standard Apache HTTP Servers – Patches from Apache
  - Remember the OS
  - Patching can be difficult!



Patching should be part of the daily operations.

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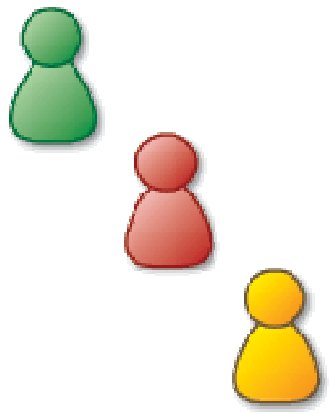
Hardening the Architecture

- Hardening the Database
  - Do **not** use the free Express Edition (XE) database
- The simple stuff
  - Follow the principle of least privilege
  - Lock or remove unused users
  - Use sensible passwords
  - SYS password != SYSTEM password
- Must-reads
  - Oracle Database Security Checklist
  - “Hacking and Securing Oracle - A Guide To Oracle Security” *by Pete Finnigan*
- A good place to start
  - Oracles Project Lockdown



Use checklists and adopt best practices

Hardening the Architecture

- Hardening the Apache HTTP Web Server
  - Remove pre-loaded modules
  - Remove pre-installed content
  - Don't publicize names/versions of your running software

ServerSignature Off (Removes server information from error pages)

ServerTokens Prod (Removes server version from the HTTP header)

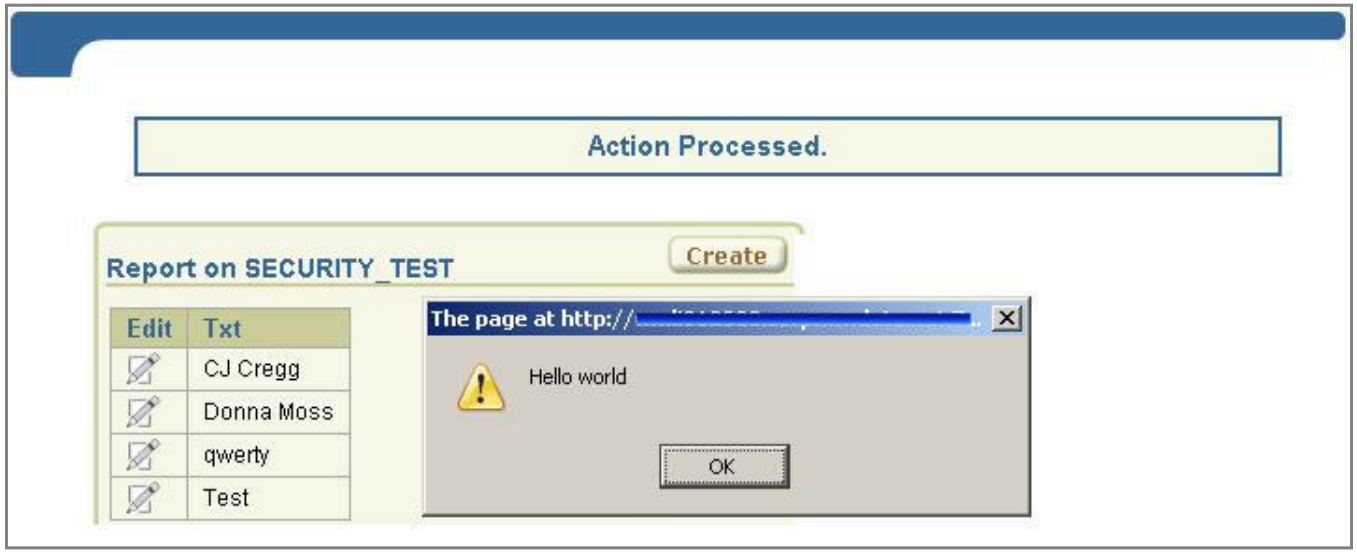
- Comprehensive Checklists
  - "Securing Oracle Application Server"
    by Caleb Sima
  - "Hardening Oracle Application Server 9i and 10g"
    by Alexander Kornbrust

Give away as little as possible about yourself

Specific Threats - Cross-Site Scripting (XSS)

- Simple definition
  - Attacker injects JavaScript in an application in order to steal data or corrupt the application
- Quick example in APEX
  - Create a Form on a table of type “Form on a Table with Report”
  - Run the Report and create a row with this data in a VARCHAR2 column

    Test<script>alert(‘Hello world’);</script>
  - When you press Create and branch back to the Report the JavaScript is executed

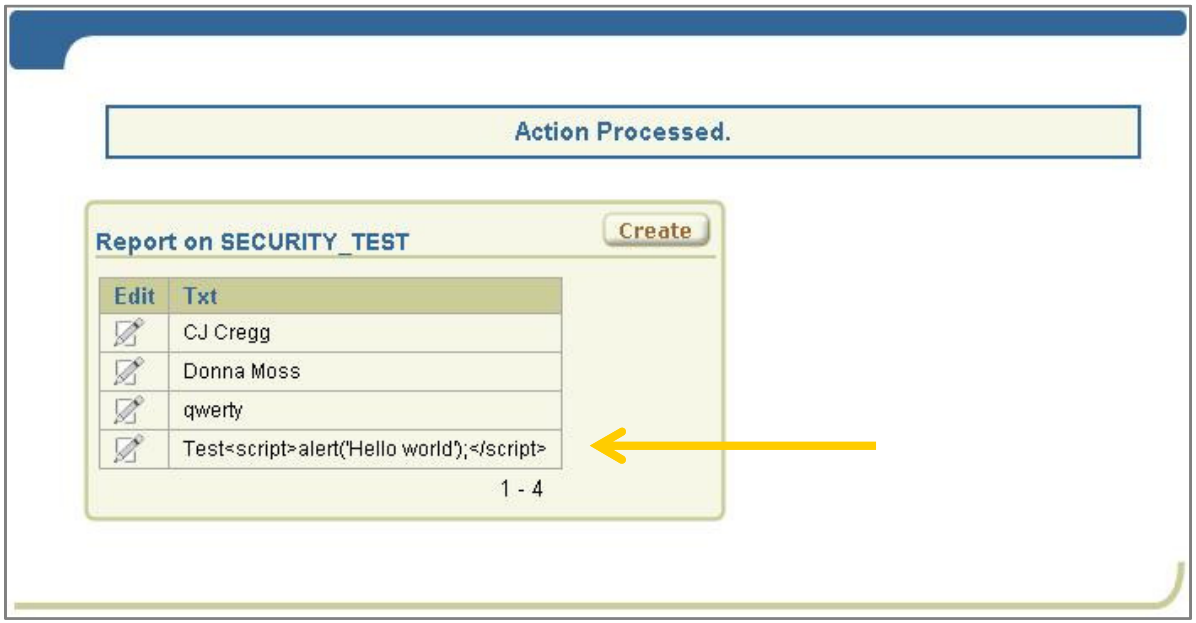


Specific Threats - Cross-Site Scripting

- Fix: Escape Special characters like <,>,&
- Change Display as

Standard Report Column

Display as text (escape special characters, does not save state)



Specific Threats - Cross-Site Scripting

- **Escaping is the weapon** of choice when dealing with XSS threats
- Escape all output
- The page source will now look like this

```
Test&lt;script&gt;alert('Hello world');&lt;/script&gt;
```

- In PL/SQL use this function: HTF.escape_sc
- Read about safe items in the User's Guide

Don't trust any input from the end-user

Specific Threats - SQL Injection

- Definition
  - An attacker inputs extra SQL in an application
- Simple example in APEX
  - Report based on a SQL Query

```
select  job, sal from emp where ename = '&P1_ENAME.'
```

  - The P1_ENAME item is input by a user
  - If an user input the text below all rows will be shown

```
qwerty' or 1=1--
```

  - The fix for this specific situation is to **use bind variables**

```
select  job, sal from emp where ename = :P1_ENAME
```

Specific Threats - SQL Injection

- Take care when an end-user can input text that is used in DML
- Watch out for concatenation of user input in DML
- Take care when using Dynamic SQL

DBMS_SQL
or
Native Dynamic SQL e.g. Execute Immediate

- Validate end-user input:
  - Check for max. length
  - Check for parentheses, comments (--, /* */)
  - Validate the input against a table

Always use Bind Variables!

Hardening APEX

- Session State Protection (SSP)
- APEX URL

42

f?p=101:7:2564045792426426::::**P7_USER_ID:99**

- APEX URL with SSP checksum

f?p=101:7:2564045792426426::::**P7_USER_ID:99**&cs=38D6164631F9364754257F3

- Use APEX_UTIL.prepare_url to generate checksum from PL/SQL
- SSP should **not be the only** security measure!
  - Also check in the database
    - Via triggers
    - Virtual Private Database (VPD)

Always use Session State Protection

Hardening APEX

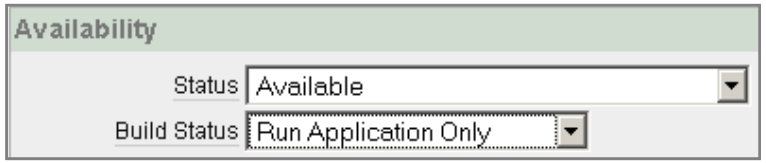
- Security Options in the Administration Services

  (Options for you production system)

  – Disable Administrator Login
  – Disable Workspace Login
  – Restrict Access by IP Address
  – Workspace Password Policy

- Miscellaneous

  – Debugging should be disabled
  – Build Status should be Run Application Only



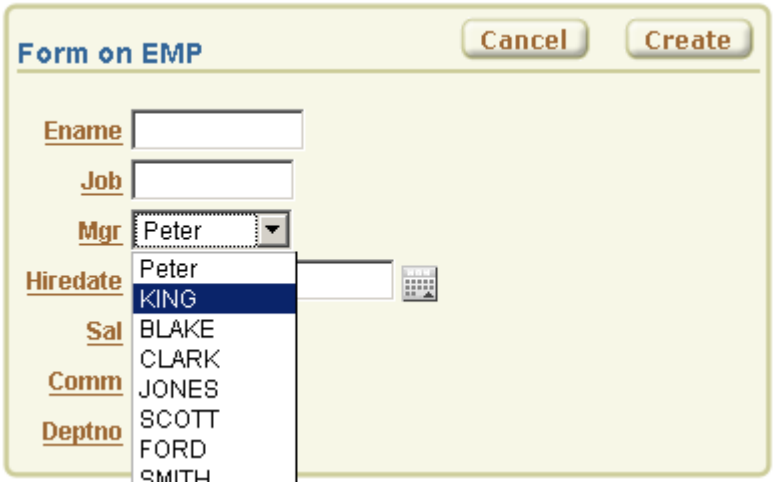
Lock down your production system

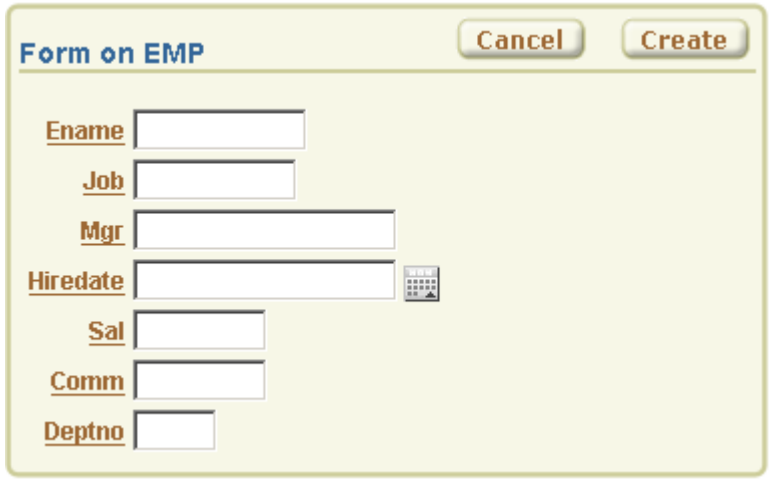
Hardening APEX

- Obfuscate the APEX_PUBLIC_USER Password
  - Use the dadTool.pl script
  - If you use marvel.conf **rename it temporarily** to dads.conf

- Checkboxes, Radio Buttons and Select Lists can be converted to text input
  - **Always** validate input!

Example using the Web Developer Firefox add-on





Secure Sockets Layer (SSL) encryption

- Check How-to's on the APEX Wiki
  - Using SSL with the Oracle HTTP Server
  - Using SSL with the Oracle XML DB HTTP Server

Conclusion

- Security is important
- Create a sensible architecture
- Use SSL encryption
- Patch everything
- Harden the database and the Apache HTTP Server
- Escape output to prevent Cross-Site Scripting
- Validate input to prevent SQL Injection
- Use Session State Protection
- Prevent admin and development access to the production APEX installation
- Obfuscate the APEX_PUBLIC_USER password
- Always validate input from Checkboxes, Radio buttons, Select lists, etc.



Questions?

Contact Information

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For More Information

- **CPU and Security Alerts**
  http://tinyurl.com/5dhto
- **Oracle Database Security Checklist**
  http://tinyurl.com/ytake2
- **"Hacking and Securing Oracle - A Guide To Oracle Security" by Pete Finnigan**
  http://tinyurl.com/28jrt7
- **Oracles Project Lockdown**
  http://tinyurl.com/24s4nf
- **"Securing Oracle Application Server" by Caleb Sima**
  http://tinyurl.com/2ey89a
- **"Hardening Oracle Application Server 9i and 10g" by Alexander Kornbrust**
  http://tinyurl.com/2x5h3h
- **APEX Wiki**
  http://tinyurl.com/2zosrp