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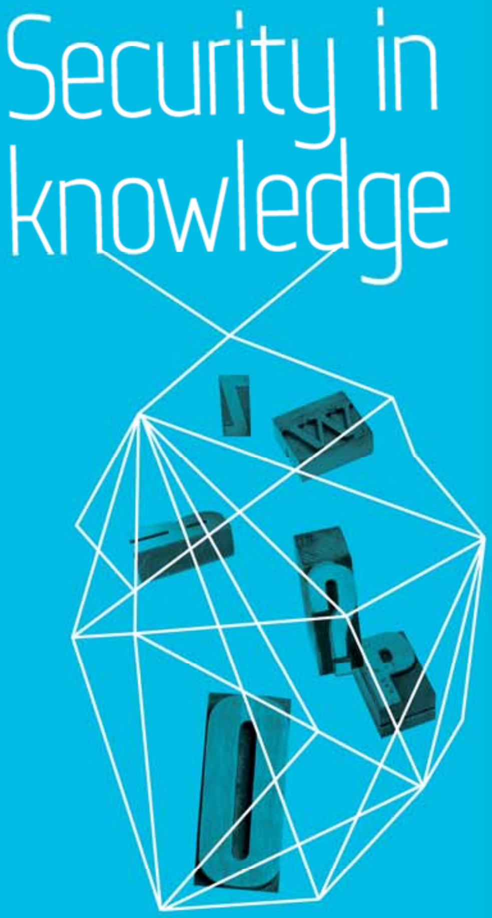

SECURE MOBILE APP DEVELOPMENT: DIFFERENCES FROM TRADITIONAL APPROACH

Suhas Desai
Aujas Information Risk Services

Session ID: MBS-T02

Session Classification: Intermediate

Agenda

- Trends in Mobile Technology
- Mobile App SDLC Challenges
- Security Risks in mobile applications
- Secure SDLC Approach

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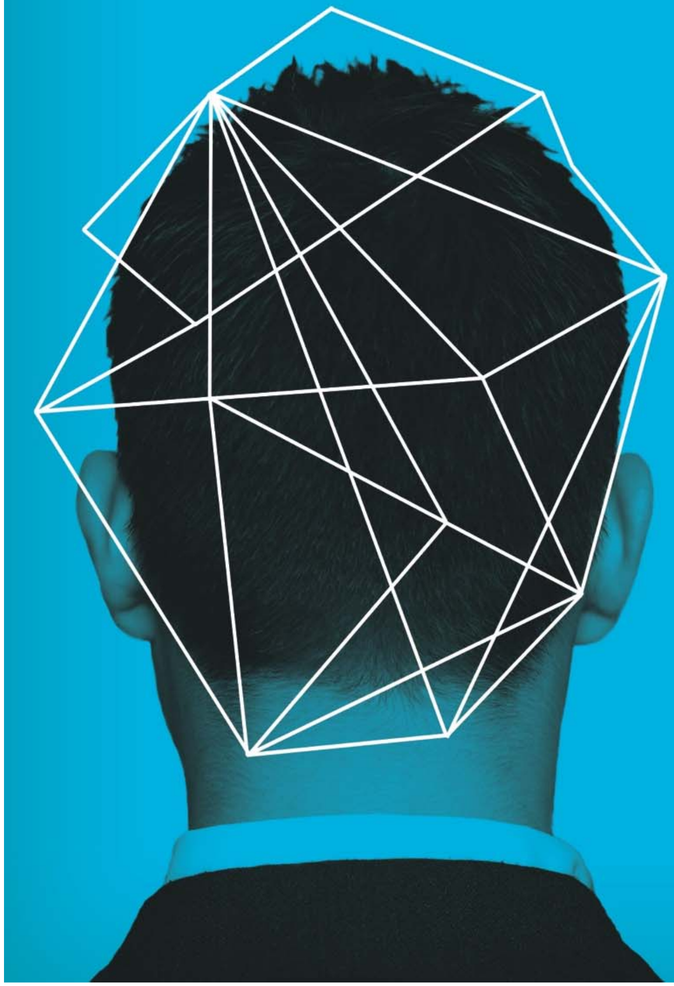


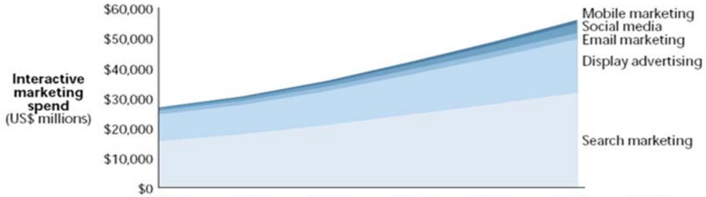
Trends in Mobile Technology

Trends in Mobile Technology

- By 2014, over 3 billion adults will be able to transact electronically
- By 2013, mobile phones will overtake PCs

(Source : Gartner)

Fig : Mobile in Marketing Industry, Forecast : 2009 -2014



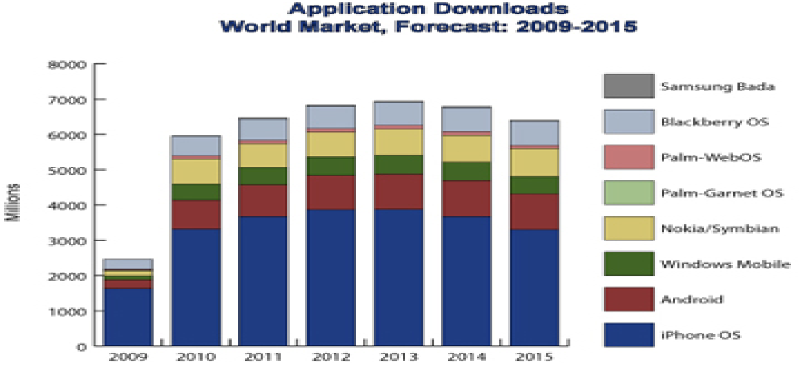
	2009	2010	2011	2012	2013	2014	CAGR
Mobile marketing	$391	$561	$748	$950	$1,131	$1,274	27%
Social media	$716	$935	$1,217	$1,649	$2,254	$3,113	34%
Email marketing	$1,248	$1,355	$1,504	$1,676	$1,867	$2,081	11%
Display advertising	$7,829	$8,395	$9,846	$11,732	$14,339	$16,900	17%
Search marketing	$15,393	$17,765	$20, 763	$24,299	$27,786	$31,588	15%
Total	**$25,577**	**$29,012**	**$34,077**	**$40,306**	**$47,378**	**$54,956**	17%
Percent of all ad spend	12%	13%	15%	17%	19%	21%	

Source: Forrester's Interactive Advertising Models, 4/09 and 10/08 (US only)

47730

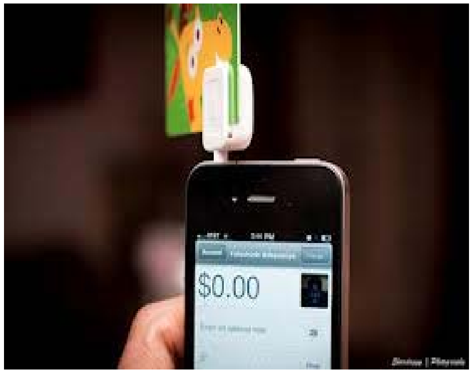
Source: Forrester Research, Inc.

Fig: Mobile App Download Market, Forecast : 2009 -2015



Source: ABI Research

Mobile Apps are everywhere!



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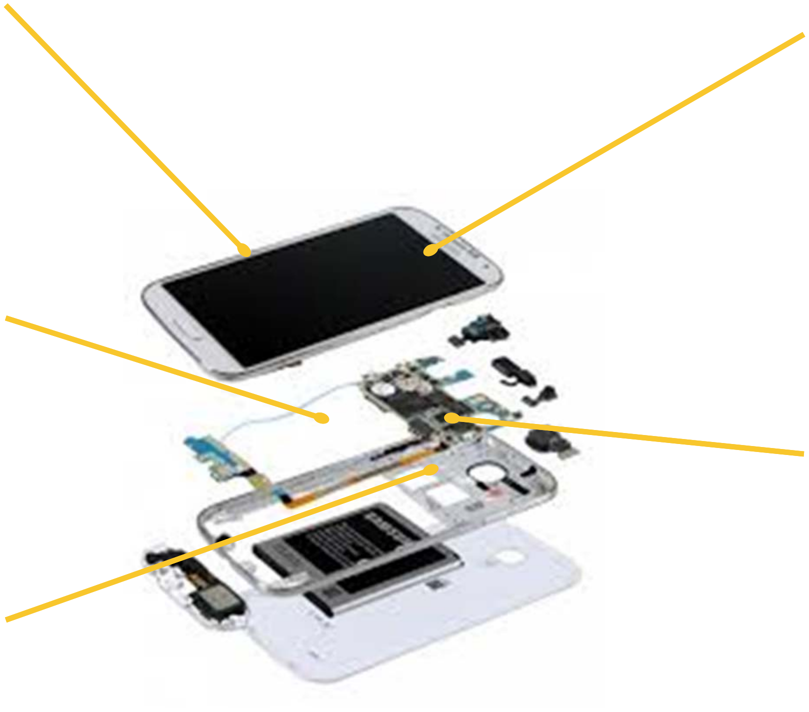
Mobile App SDLC Challenges over traditional application SDLC

Mobile App SDLC Challenges



Support for various displays and screen sizes

Effective usage of local device database & memory

Releasing secure (signed) application executables

Rich user interfaces with push notifications (Wherever applicable)

Effective usage of communication channels – SMS / USSD (Unstructured Supplementary Service Data) / IP and web services

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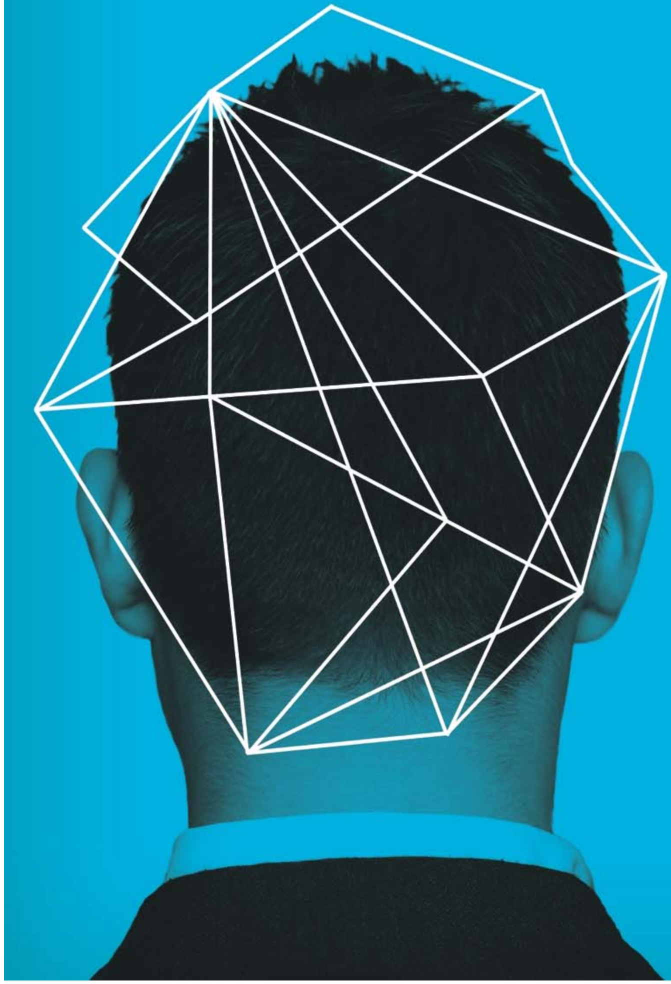
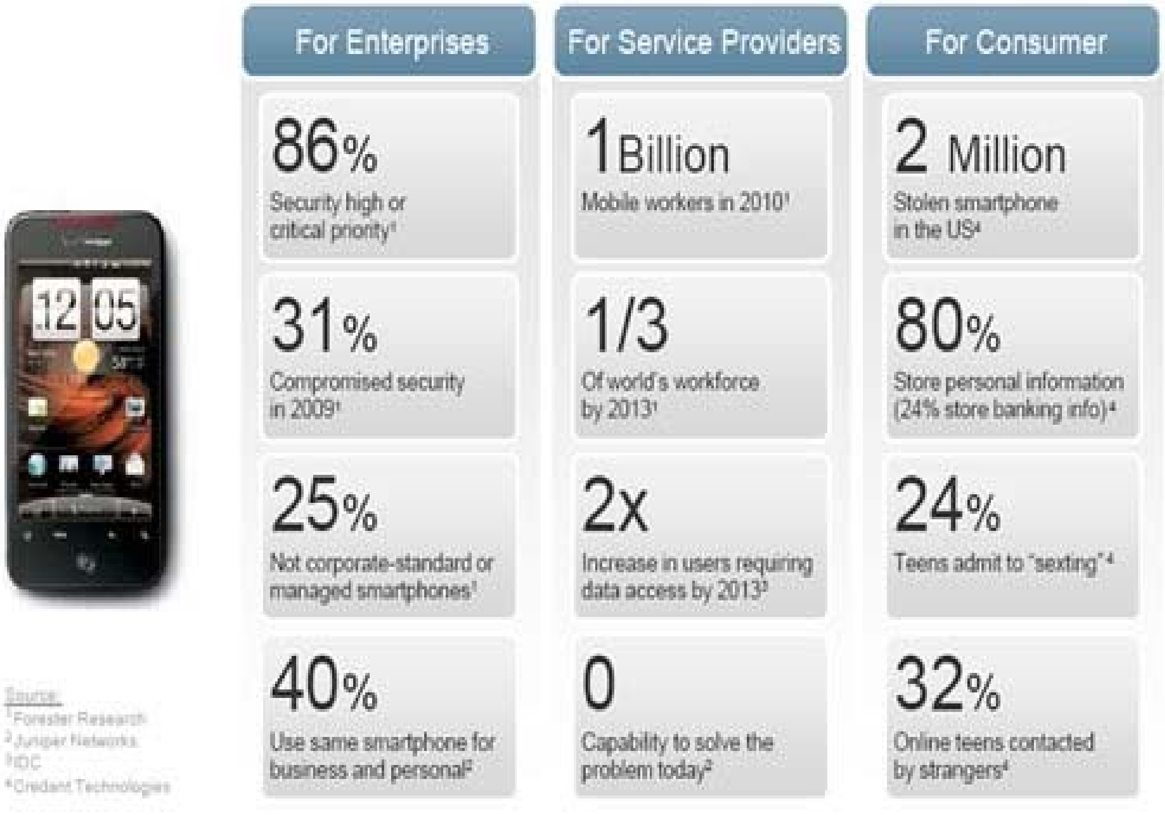


Security Risks in Mobile Applications

Stats : Mobile threats

"The Smartphone OS will become a major security target," said Android Security Leader Rich Cannings, speaking at the Usenix Security Symposium.



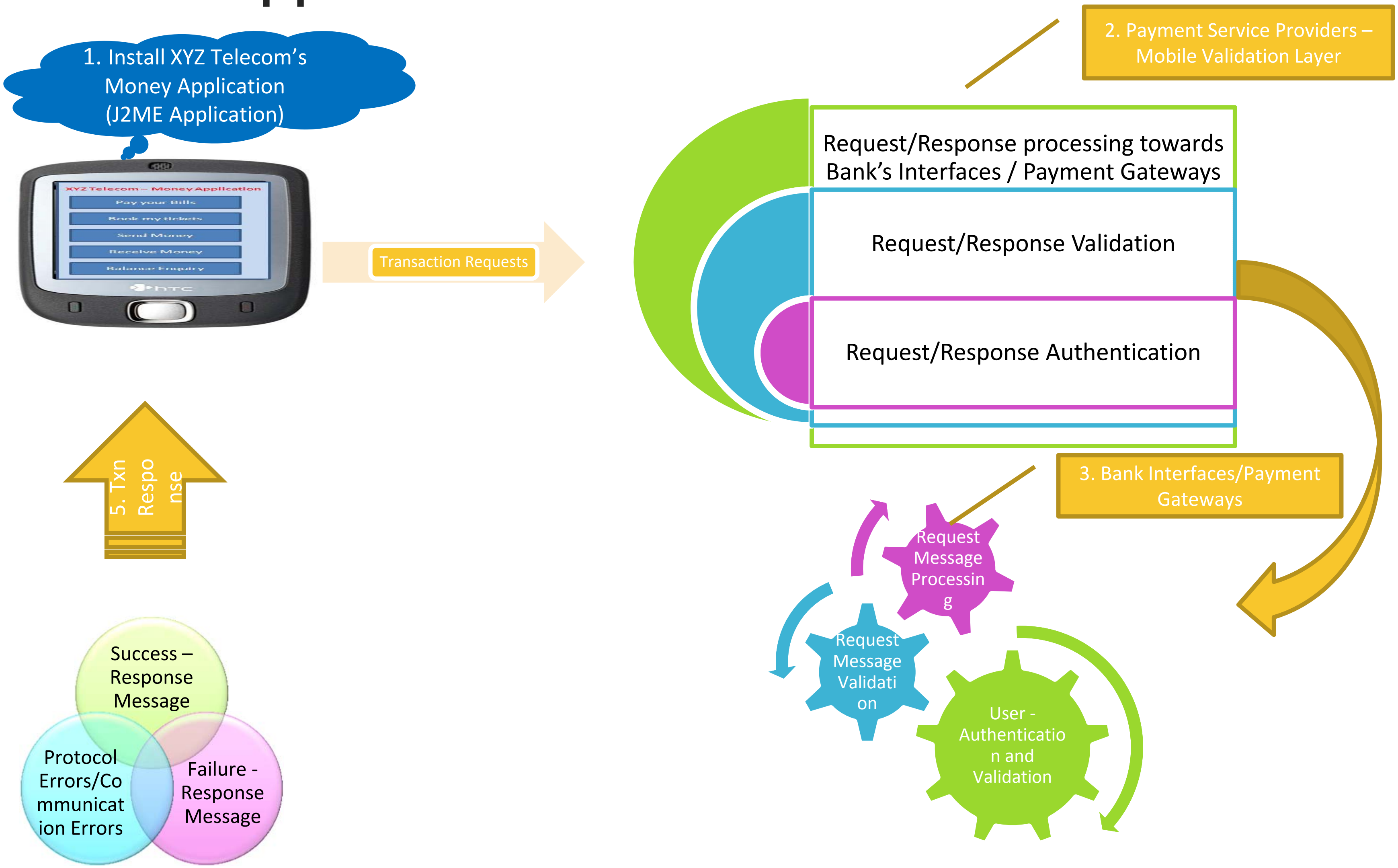
For Enterprises	For Service Providers	For Consumer
86% Security high or critical priority[1]	1 Billion Mobile workers in 2010[1]	2 Million Stolen smartphone in the US[4]
31% Compromised security in 2009[1]	1/3 Of world's workforce by 2013[1]	80% Store personal information (24% store banking info)[4]
25% Not corporate-standard or managed smartphones[1]	2x Increase in users requiring data access by 2013[3]	24% Teens admit to "sexting"[4]
40% Use same smartphone for business and personal[2]	0 Capability to solve the problem today[2]	32% Online teens contacted by strangers[4]

Source:
[1] Forester Research
[2] Juniper Networks
[3] IDC
[4] Credant Technologies

Risks in Mobile Applications

- Fraudulent Transactions through message tampering
- Weak Cryptography
- Mobile Application Server Issues
- Reverse Engineering Threats
- Communication Channel Attacks – SMS / USSD
- Web Services Attacks
- Device lost/theft case scenarios

Mobile Application Architecture



1. Install XYZ Telecom's Money Application (J2ME Application)

Transaction Requests

2. Payment Service Providers – Mobile Validation Layer

Request/Response processing towards Bank's Interfaces / Payment Gateways

Request/Response Validation

Request/Response Authentication

3. Bank Interfaces/Payment Gateways

Request Message Processin g

Request Message Validati on

User - Authenticatio n and Validation

5. Txn Respo nse

Success – Response Message

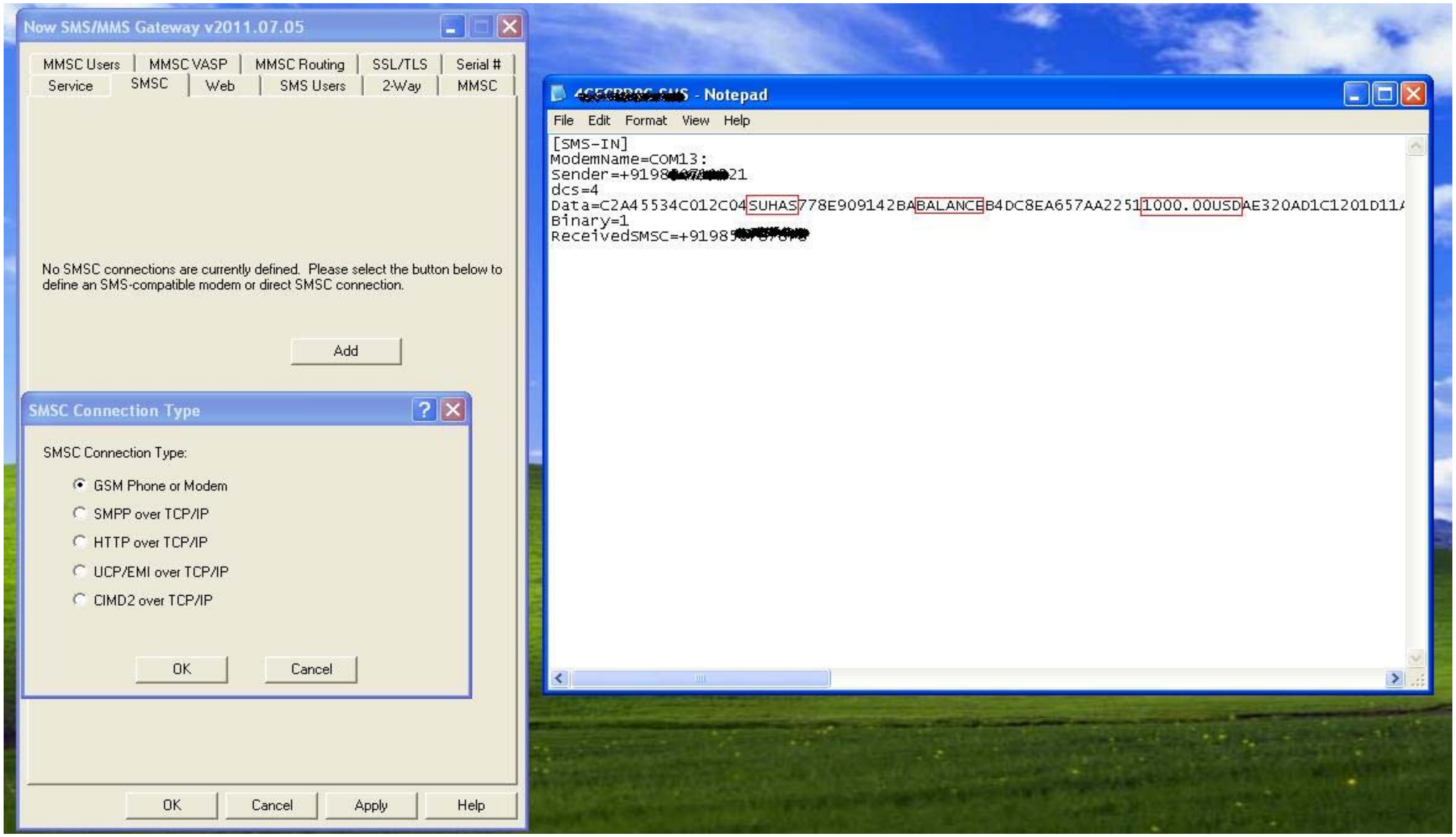
Protocol Errors/Co mmunicat ion Errors

Failure - Response Message

Attack vector

- Reverse engineering of mobile application
- Transactions Request/Response Attacks
- Message Replay Attack
- Fraudulent Transactions through Data storage
- Verify strong Cryptographic Implementation
- Improper Session Management
- Authentication Attacks
- Web Services Attacks

PoC – SMS Req/Res Attacks



No SMSC connections are currently defined. Please select the button below to define an SMS-compatible modem or direct SMSC connection.

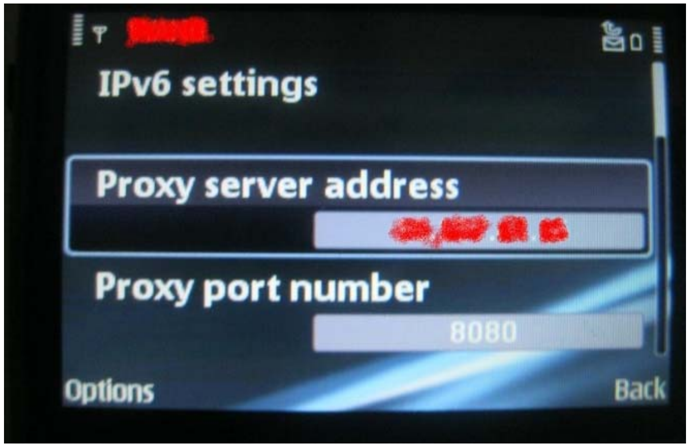
SMSC Connection Type:

- ● GSM Phone or Modem
- ○ SMPP over TCP/IP
- ○ HTTP over TCP/IP
- ○ UCP/EMI over TCP/IP
- ○ CIMD2 over TCP/IP

```
[SMS-IN]
ModemName=COM13:
Sender=+9198[redacted]21
dcs=4
Data=C2A45534C012C04SUHAS778E909142BABALANCEB4DC8EA657AA22511000.00USDAE320AD1C1201D11
Binary=1
ReceivedSMSC=+9198[redacted]
```

Figure 1. Application SMS Req / Res Attack

PoC – Message Replay Attacks



[redacted]

IPv6 settings

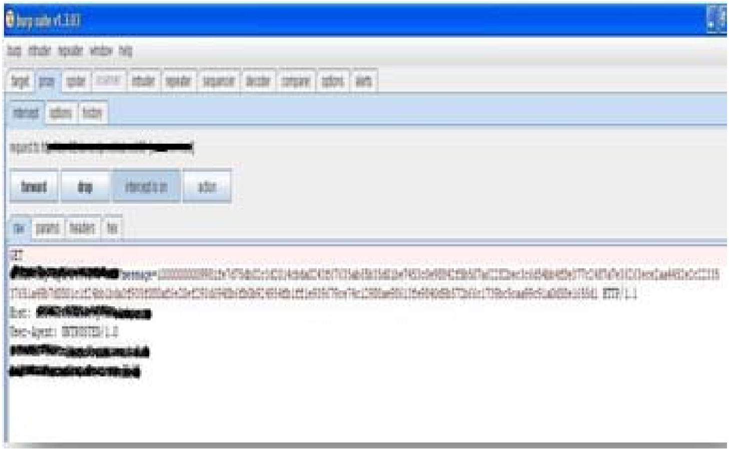
Proxy server address

[redacted]

Proxy port number

8080

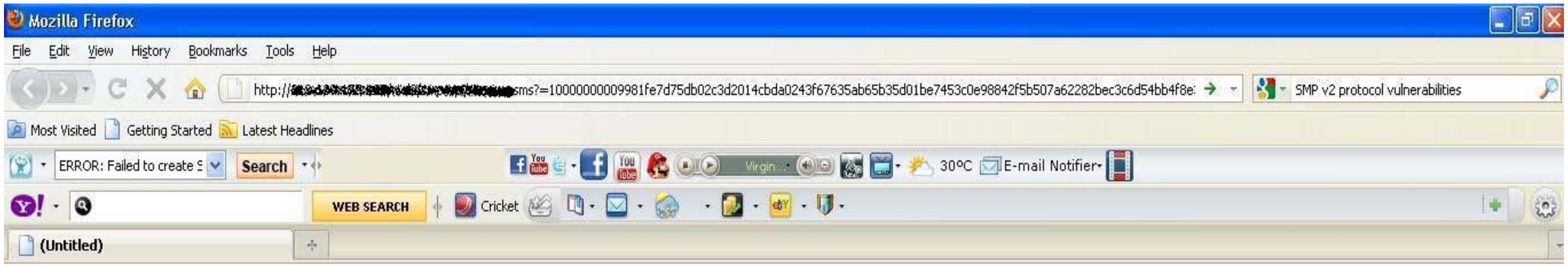
Figure 1. Proxy Settings



request to [redacted]

```
GET
[redacted]message=[illegible] HTTP/1.1
Host: [redacted]
User-Agent: [illegible]
[redacted]
```

Figure 2. Intercepted Message

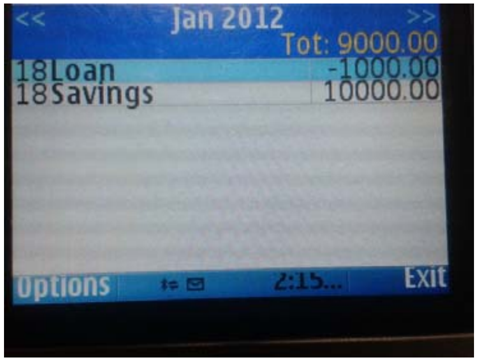


http://[redacted]sms?=10000000009981fe7d75db02c3d2014cbda0243f67635ab65b35d01be7453c0e98842f5b507a62282bec3c6d54bb4f8e:

SMP v2 protocol vulnerabilities

Figure 3. Message Replay Attack

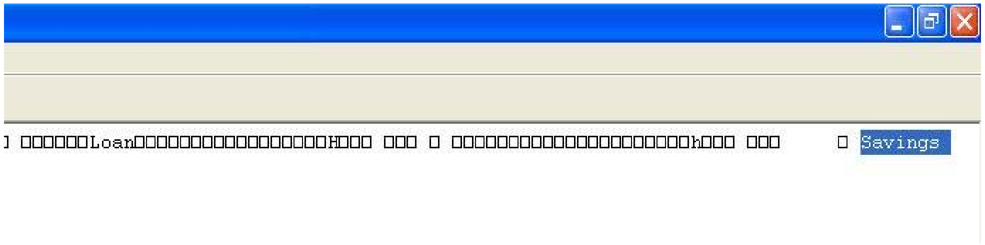
PoC – Local data modification



Tot: 9000.00

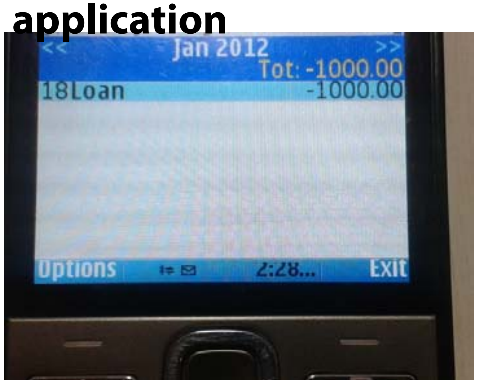
18Loan	-1000.00
18Savings	10000.00

Figure 1. Original application



```
] □□□□□□Loan□□□□□□□□□□□□□□□□□□H□□□ □□□ □ □□□□□□□□□□□□□□□□□□□□□□□h□□□ □□□      □ Savings
```

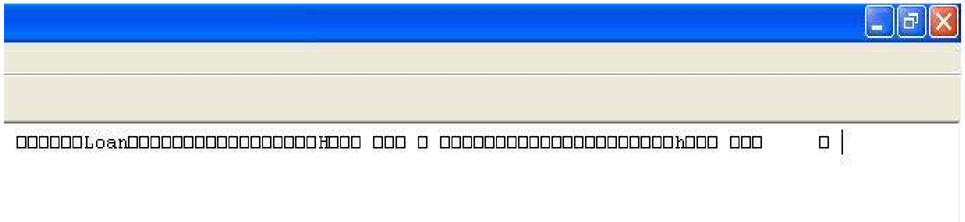
Figure 2. Local database modification



Tot: -1000.00

18Loan	-1000.00

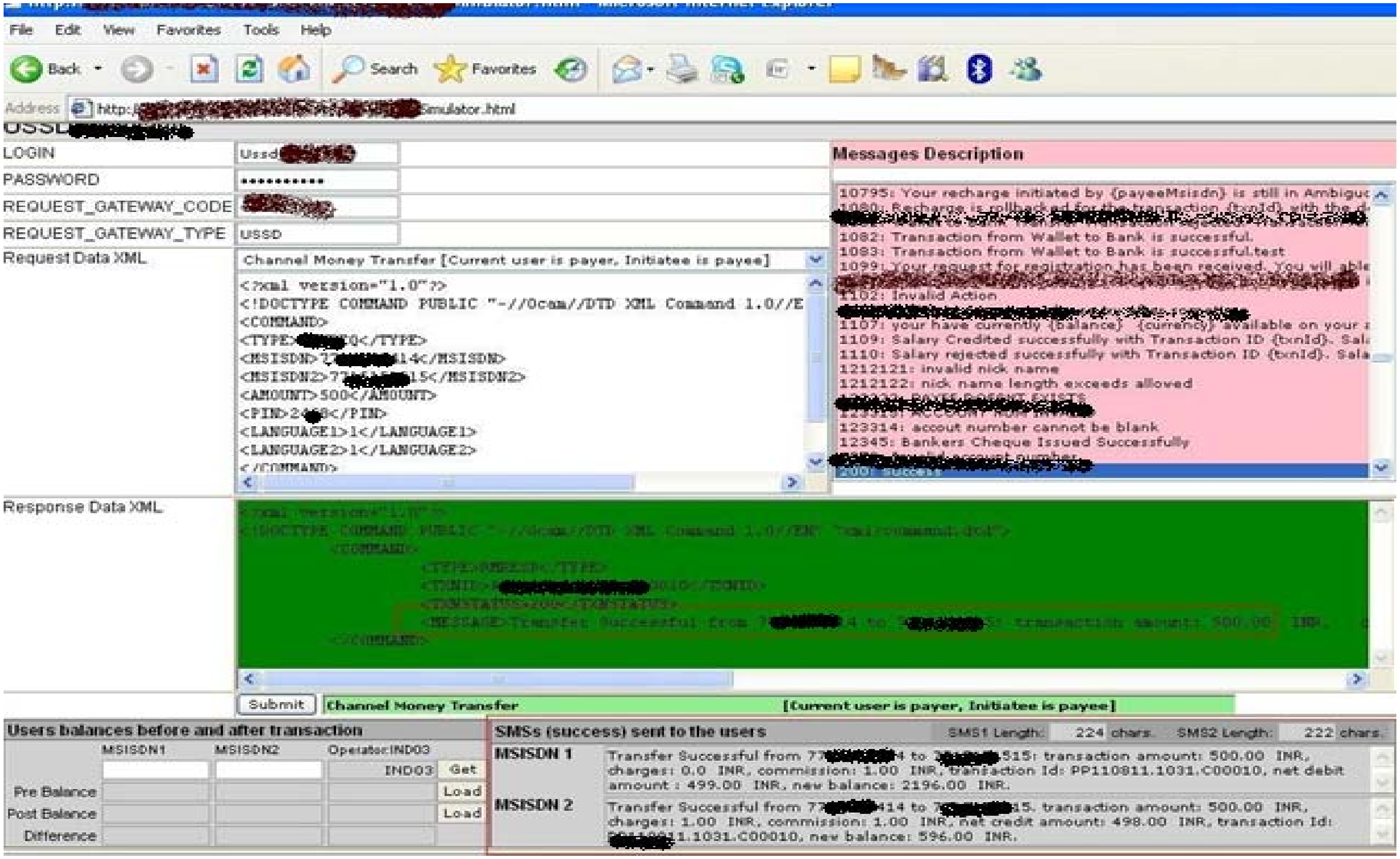
Figure 4. Modified application



```
□□□□□□Loan□□□□□□□□□□□□□□□□□□H□□□ □□□ □ □□□□□□□□□□□□□□□□□□□□□□□h□□□ □□□      □
```

Figure 3. Local database modified

PoC – USSD Gateway Attack



http:[redacted] - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Address
http:[redacted]Simulator.html

USSD[redacted]

LOGIN	Ussd[redacted]
PASSWORD	***********
REQUEST_GATEWAY_CODE	[redacted]
REQUEST_GATEWAY_TYPE	USSD
Request Data XML	Channel Money Transfer [Current user is payer, Initiatee is payee]

```
<?xml version="1.0"?>
<!DOCTYPE COMMAND PUBLIC "-//Ocam//DTD XML Command 1.0//E
<COMMAND>
<TYPE>[redacted]Q</TYPE>
<MSISDN>7[redacted]14</MSISDN>
<MSISDN2>77[redacted]15</MSISDN2>
<AMOUNT>500</AMOUNT>
<PIN>24[redacted]</PIN>
<LANGUAGE1>1</LANGUAGE1>
<LANGUAGE2>1</LANGUAGE2>
</COMMAND>
```

Messages Description

```
10795: Your recharge initiated by {payeeMsisdn} is still in Ambiguc
1080: Recharge is rollbacked for the transaction {txnId} with the d
[redacted]
1082: Transaction from Wallet to Bank is successful.
1083: Transaction from Wallet to Bank is successful.test
1099: Your request for registration has been received. You will able
[redacted]
1102: Invalid Action
[redacted]
1107: your have currently {balance}  {currency} available on your a
1109: Salary Credited successfully with Transaction ID {txnId}. Sala
1110: Salary rejected successfully with Transaction ID {txnId}. Sala
1212121: invalid nick name
1212122: nick name length exceeds allowed
[redacted]
123314: accout number cannot be blank
12345: Bankers Cheque Issued Successfully
[redacted]
200: success
```

Response Data XML

```
<?xml version="1.0"?>
<!DOCTYPE COMMAND PUBLIC "-//Ocam//DTD XML Command 1.0//EN" "xml/command.dtd">
        <COMMAND>
                <TYPE>[illegible]</TYPE>
                <TXNID>[redacted]0010</TXNID>
                <TXNSTATUS>200</TXNSTATUS>
                <MESSAGE>Transfer Successful from 7[redacted]4 to 7[redacted]5: transaction amount: 500.00  INR,  c
        </COMMAND>
```

Submit | Channel Money Transfer [Current user is payer, Initiatee is payee]

Users balances before and after transaction

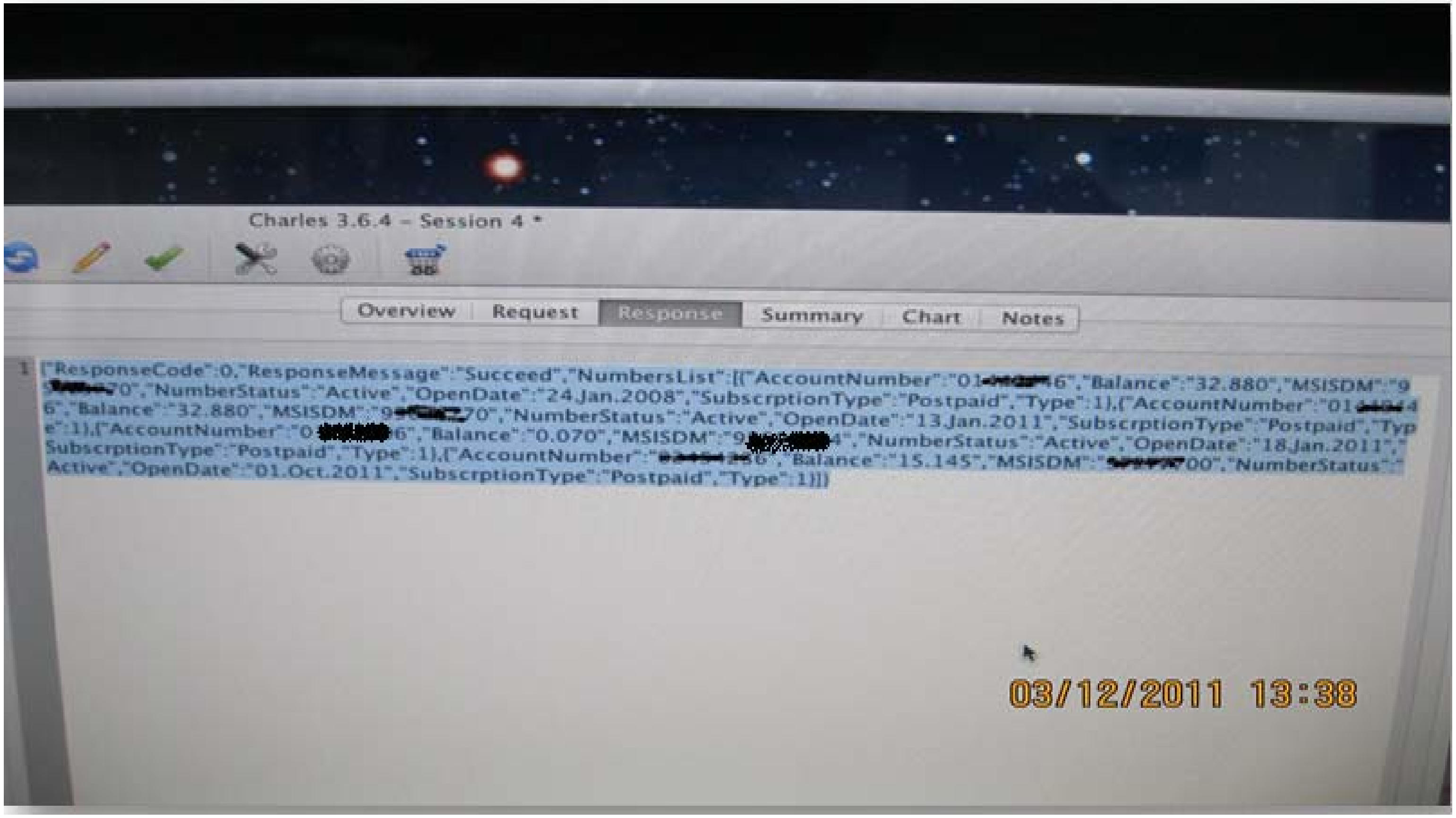
	MSISDN1	MSISDN2	Operator:IND03	
			IND03	Get
Pre Balance				Load
Post Balance				Load
Difference				

SMSs (success) sent to the users SMS1 Length: 224 chars. SMS2 Length: 222 chars.

MSISDN 1	Transfer Successful from 77[redacted]4 to 7[redacted]515: transaction amount: 500.00 INR, charges: 0.0 INR, commission: 1.00 INR, transaction Id: PP110811.1031.C00010, net debit amount : 499.00 INR, new balance: 2196.00 INR.
MSISDN 2	Transfer Successful from 77[redacted]414 to 7[redacted]15. transaction amount: 500.00 INR, charges: 1.00 INR, commission: 1.00 INR, net credit amount: 498.00 INR, transaction Id: [redacted]1.1031.C00010, new balance: 596.00 INR.

Figure 1. USSD Gateway Emulator

PoC: iOS App R/R capture

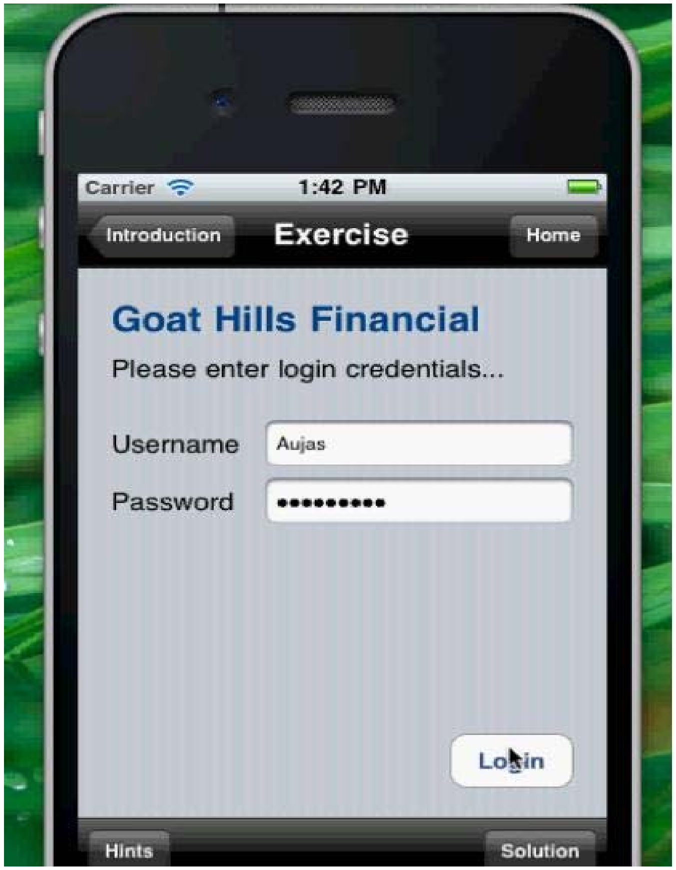


```
{"ResponseCode":0,"ResponseMessage":"Succeed","NumbersList":[{"AccountNumber":"01[redacted]6","Balance":"32.880","MSISDM":"9
[redacted]0","NumberStatus":"Active","OpenDate":"24Jan.2008","SubscrptionType":"Postpaid","Type":1},{"AccountNumber":"01[redacted]4
6","Balance":"32.880","MSISDM":"9[redacted]70","NumberStatus":"Active","OpenDate":"13Jan.2011","SubscrptionType":"Postpaid","Typ
e":1},{"AccountNumber":"0[redacted]6","Balance":"0.070","MSISDM":"9[redacted]4","NumberStatus":"Active","OpenDate":"18Jan.2011","
SubscrptionType":"Postpaid","Type":1},{"AccountNumber":"[redacted]6","Balance":"15.145","MSISDM":"[redacted]00","NumberStatus":"
Active","OpenDate":"01.Oct.2011","SubscrptionType":"Postpaid","Type":1}]}
```

03/12/2011 13:38

Figure 1. Request/Response Capture

PoC: iOS App R/R Tampering



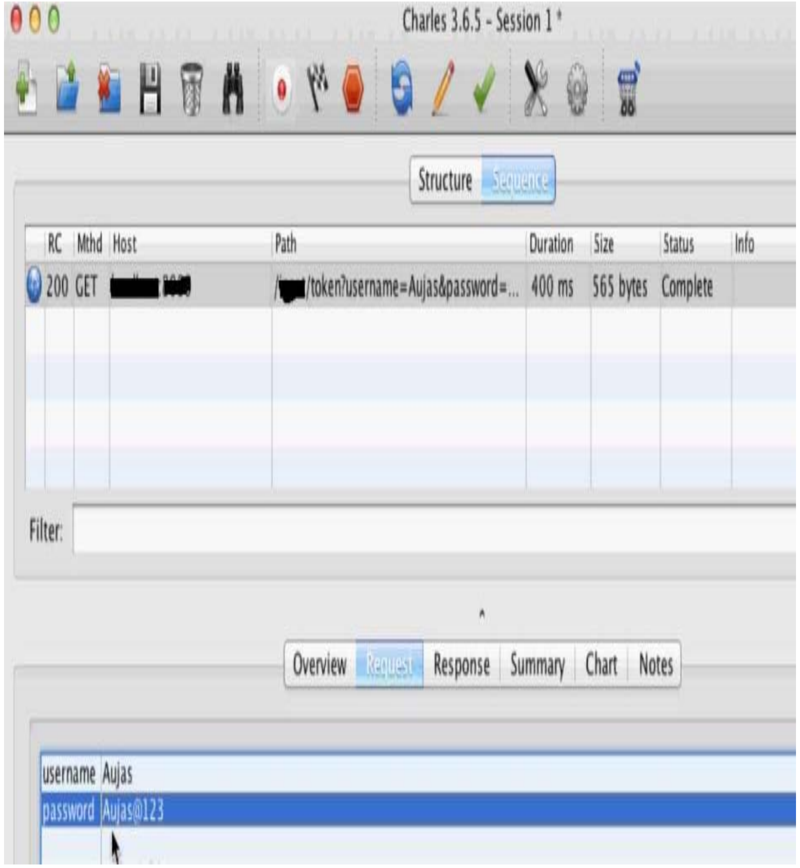
Goat Hills Financial

Please enter login credentials...

Username: Aujas

Password: ••••••••••

Figure 1. Entering Credentials



RC	Mthd	Host	Path	Duration	Size	Status	Info
200	GET	[redacted]	/[redacted]/token?username=Aujas&password=...	400 ms	565 bytes	Complete	

Filter:

username	Aujas
password	Aujas@123

Figure 2. Intercepted Message

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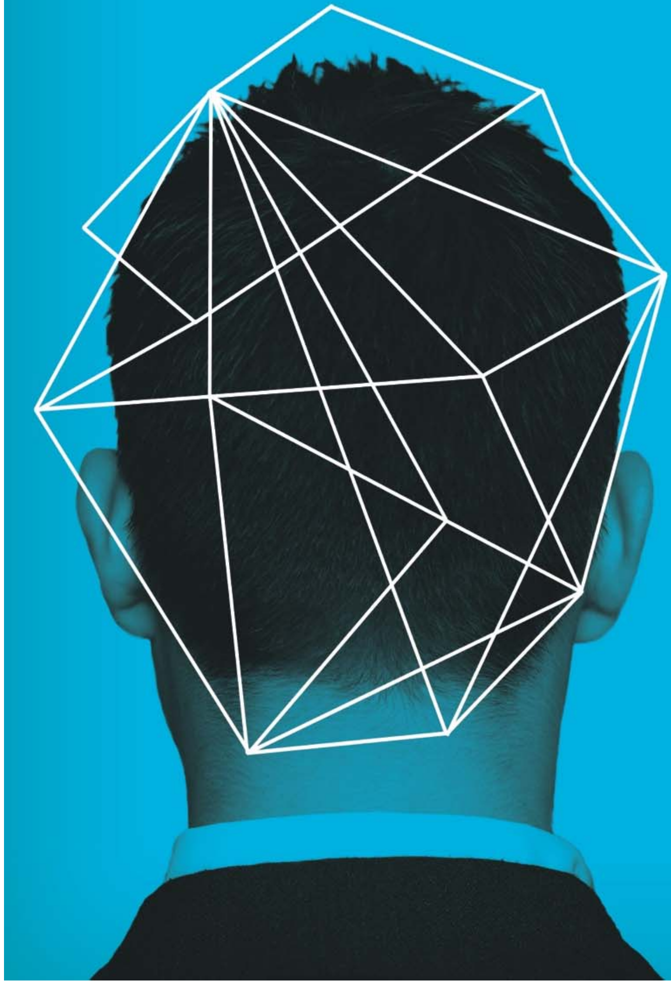

Secure SDLC Approach

Secure SDLC Approach

Requirements

- Software risk profile
- Security requirement definition
- Security investment analysis

Design

- Threat modeling
- Security arch design
- Security controls
- Developer training

Development

- Secure coding best practices
- Secure code libraries
- Pair programming / peer reviews

Release

- Functional, architecture, code & deployment testing
- Security controls validation
- Remediation

Sustenance

- Security metrics analysis
- Change management
- Incident & consequence management

Secure SDLC – Best Practices

- Secure data transmission
- Secure data storage
- Ensure to implement proper session management
- Validate all trusted and un-trusted inputs
- Ensure to implement strong authentication mechanism

Contd..

- Ensure to implement response and request messages encryption
- Ensure to implement proper message authentication mechanism to validate requests/responses are generated through authenticated users
- Ensure to implement and use Secure SMS/USSD/IP communication channels
- Secure Interface between payment gateways and mobile payment application

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Thank You!

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