

# **Informix Client/Server Encryption**

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# Tom Beebe



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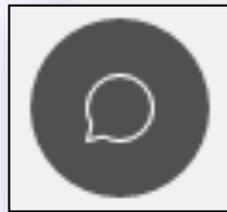
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# Webcast Guidelines

- The webcast is being recorded. The webcast replay and slides will be available in a few days.
- Please mute your Line - background sounds will distract everyone.
- Use the Chat button in the toolbar at the bottom of the screen to ask questions.



# Agenda

- What is encryption?
- Why do we want to use it for Informix?
- Considerations
- Configuring the Server
- Configuring the Client
- Putting it all together

# What is Encryption?

- Protecting data by encapsulating it in a way that only trusted parties can read it
- Many different forms and implementations
- Uses CPU to encrypt to send and more CPU to decrypt when received
- Can be configured for desired strength

# PKI (Public Key Infrastructure)

- Common method of encryption (see HTTPS)
- Two keys are needed, a public key that is okay to share and a private key that only the server should know
- A CA (certificate authority) issues the keys - for this exercise we will 'self-sign' and act as our own CA

# How Informix Uses PKI

1. Server sends digital certificate to client
2. Client verifies the digital certificate
3. If validated the client creates a limited use key, encrypts it using the server's public key and sends it to the server
4. Server gets the key, decrypts it, and will use the limited use key as long as the session is active
5. All further data on that connection is now encrypted, and only known to the two sides

# Why Is Encryption Important For Informix?

- Avoid someone sniffing passwords
- Verify that the server you connect to is valid
- Avoid having someone stand between you and your server (man in the middle)
- Avoid having your data watched by a third party, by default data is sent in clear text
- Comply with many regulations that require it
- Have data encrypted the entire way to and from the client and server

\*Ethernet0

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression...

| No. | Time      | Source       | Destination  | Protocol | Length | Info   |
|-----|-----------|--------------|--------------|----------|--------|--|
| 39  | 9.716623  | 10.19.49.131 | 10.19.49.130 | TCP      | 66     | 51915 → 9088 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SAC |
| 41  | 9.716866  | 10.19.49.131 | 10.19.49.130 | TCP      | 54     | 51915 → 9088 [ACK] Seq=1 Ack=1 Win=525568 Len=0              |
| 42  | 9.716972  | 10.19.49.131 | 10.19.49.130 | TCP      | 502    | 51915 → 9088 [PSH, ACK] Seq=1 Ack=1 Win=525568 Len=448       |
| 45  | 9.720994  | 10.19.49.131 | 10.19.49.130 | TCP      | 70     | 51915 → 9088 [PSH, ACK] Seq=449 Ack=321 Win=525056 Len=16    |
| 47  | 9.727556  | 10.19.49.131 | 10.19.49.130 | TCP      | 432    | 51915 → 9088 [PSH, ACK] Seq=465 Ack=337 Win=525056 Len=378   |
| 49  | 9.729563  | 10.19.49.131 | 10.19.49.130 | TCP      | 58     | 51915 → 9088 [PSH, ACK] Seq=843 Ack=339 Win=525056 Len=4     |
| 51  | 9.774129  | 10.19.49.131 | 10.19.49.130 | TCP      | 54     | 51915 → 9088 [ACK] Seq=847 Ack=401 Win=525056 Len=0          |
| 52  | 10.639463 | 10.19.49.131 | 10.19.49.130 | TCP      | 106    | 51915 → 9088 [PSH, ACK] Seq=847 Ack=401 Win=525056 Len=52    |
| 54  | 10.639754 | 10.19.49.131 | 10.19.49.130 | TCP      | 62     | 51915 → 9088 [PSH, ACK] Seq=899 Ack=447 Win=525056 Len=8     |
| 56  | 10.680202 | 10.19.49.131 | 10.19.49.130 | TCP      | 54     | 51915 → 9088 [ACK] Seq=907 Ack=475 Win=525056 Len=0          |

> Frame 42: 502 bytes on wire (4016 bits), 502 bytes captured (4016 bits) on interface 0

> Ethernet II, Src: Vmware\_c8:ab:9f (00:0c:29:c8:ab:9f), Dst: Vmware\_f1:69:94 (00:0c:29:f1:69:94)

> Internet Protocol Version 4, Src: 10.19.49.131, Dst: 10.19.49.130

> Transmission Control Protocol, Src Port: 51915, Dst Port: 9088, Seq: 1, Ack: 1, Len: 448

> Data (448 bytes)

```

0000 00 0c 29 f1 69 94 00 0c 29 c8 ab 9f 08 00 45 00  ..).i... ).....E.
0010 01 e8 07 6e 40 00 80 06 00 00 0a 13 31 83 0a 13  ...n@... ..1...
0020 31 82 ca cb 23 80 78 96 0b 20 70 9d 9e 49 50 18  1...#.x. .p.IP.
0030 08 05 79 05 00 00 73 71 41 62 77 42 50 51 41 41  ..y...sq AbwBPQAA
0040 73 71 6c 65 78 65 63 20 62 6f 62 20 2d 70 69 66  sqlexec bob -pif
0050 78 70 61 73 73 20 39 2e 32 34 30 20 52 44 53 23  xpass 9. 240 RDS#
0060 4e 30 30 30 30 30 20 2d 70 20 2d 66 49 45 45  N000000 -p -fIEE
0070 45 49 20 44 42 50 41 54 48 3d 2f 2f 69 66 78 5f  EI DBPAT H=//ifx_
0080 73 65 72 76 65 72 5f 74 63 70 20 43 4c 49 45 4e  server_t cp CLIEN
0090 54 5f 4c 4f 43 41 4c 45 3d 65 6e 5f 55 53 2e 38  T_LOCALE =en_US.8
00a0 38 35 39 2d 31 20 4e 4f 44 45 46 44 41 43 3d 6e  859-1 NO DEFDAC=n
00b0 6f 20 43 4c 4e 54 5f 50 41 4d 5f 43 41 50 41 42  o CLNT_P AM_CAPAB
00c0 4c 45 3d 31 20 3a 41 47 30 41 41 41 41 39 62 32  LE=1 :AG 0AAAAA9b2
00d0 34 41 41 41 41 41 41 41 41 41 41 41 41 39 63 32  4AAAAAAAA AAAAAA9c2
00e0 39 6a 64 47 4e 77 41 41 41 41 41 41 41 42 41 41  9jdGNwAA AAAAAABAA
00f0 41 42 50 41 41 41 41 41 41 41 41 41 41 63 33  ABPAAAAA AAAAAAc3
0100 46 73 5a 58 68 6c 59 77 41 41 41 41 41 41 41 41  FsZXhlyw AAAAAAAAA
0110 56 7a 63 57 78 70 41 41 41 4c 41 41 41 41 41 77  VzCWxpAA ALAAAAAw
0120 41 50 61 57 5a 34 58 33 4e 6c 63 6e 5a 6c 63 6c  APaWZ4X3 NlcnZlc1
0130 39 30 59 33 41 41 41 47 73 41 41 41 41 41 41 41  90Y3AAAG sAAAAAAA

```

wireshark\_Ethernet0\_20190410184054\_a06468.pcapng | Packets: 82 · Displayed: 82 (100.0%) · Dropped: 0 (0.0%) | Profile: Default

\*Ethernet0

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression... +

| No. | Time      | Source       | Destination  | Protocol  | Length | Info  |
|-----|-----------|--------------|--------------|-----------|--------|---|
| 51  | 9.774129  | 10.19.49.131 | 10.19.49.130 | TCP       | 54     | 51915 → 9088 [ACK] Seq=847 Ack=401 Win=525056 Len=0       |
| 52  | 10.639463 | 10.19.49.131 | 10.19.49.130 | TCP       | 106    | 51915 → 9088 [PSH, ACK] Seq=847 Ack=401 Win=525056 Len=52 |
| 54  | 10.639754 | 10.19.49.131 | 10.19.49.130 | TCP       | 62     | 51915 → 9088 [PSH, ACK] Seq=899 Ack=447 Win=525056 Len=8  |
| 56  | 10.680393 | 10.19.49.131 | 10.19.49.130 | TCP       | 54     | 51915 → 9088 [ACK] Seq=907 Ack=475 Win=525056 Len=0       |
| 60  | 16.172870 | 10.19.49.131 | 10.19.49.130 | TCP       | 88     | 51915 → 9088 [PSH, ACK] Seq=907 Ack=475 Win=525056 Len=34 |
| 62  | 16.224733 | 10.19.49.131 | 10.19.49.130 | CLASSI... | 74     | Message: Send Request                                     |
| 64  | 16.229043 | 10.19.49.131 | 10.19.49.130 | TCP       | 68     | 51915 → 9088 [PSH, ACK] Seq=961 Ack=667 Win=524800 Len=14 |
| 67  | 16.229222 | 10.19.49.131 | 10.19.49.130 | TCP       | 54     | 51915 → 9088 [ACK] Seq=975 Ack=2437 Win=525568 Len=0      |
| 69  | 17.705966 | 10.19.49.131 | 10.19.49.130 | TCP       | 62     | 51915 → 9088 [PSH, ACK] Seq=975 Ack=2437 Win=525568 Len=8 |
| 71  | 17.706340 | 10.19.49.131 | 10.19.49.130 | TCP       | 62     | 51915 → 9088 [PSH, ACK] Seq=983 Ack=2430 Win=525568 Len=8 |

[Calculated window size: 525056]  
 [Window size scaling factor: 256]  
 Checksum: 0x7767 [unverified]  
 [Checksum Status: Unverified]  
 Urgent pointer: 0

```

0000  00 0c 29 f1 69 94 00 0c 29 c8 ab 9f 08 00 45 00  .i... ).....E.
0010  00 4a 07 76 40 00 80 06 00 00 0a 13 31 83 0a 13  .J.v@... ..1..
0020  31 82 ca cb 23 80 78 96 0e aa 70 9d a0 23 50 18  1..#x. .p.#P.
0030  08 03 77 67 00 00 00 02 00 00 00 00 00 13 73 65  ..wg.....se
0040  6c 65 63 74 20 2a 20 66 72 6f 6d 20 69 74 65 6d  lect * f rom item
0050  73 00 00 16 00 31 00 0c                               s...1..
  
```

Urgent pointer (tcp.urgent\_pointer), 2 bytes

Packets: 82 · Displayed: 82 (100.0%) · Dropped: 0 (0.0%) | Profile: Default

\*Ethernet0

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/> Expression... +

| No. | Time     | Source       | Destination   | Protocol | Length | Info  |
|-----|----------|--------------|---------------|----------|--------|---|
| 7   | 2.489002 | 10.19.49.130 | 10.19.49.131  | TCP      | 348    | 9088 → 51915 [PSH, ACK] Seq=1 Ack=35 Win=254 Len=294    |
| 9   | 2.489689 | 10.19.49.130 | 10.19.49.131  | TCP      | 60     | 9088 → 51915 [PSH, ACK] Seq=295 Ack=55 Win=254 Len=2    |
| 11  | 2.489865 | 10.19.49.130 | 10.19.49.131  | TCP      | 1514   | 9088 → 51915 [ACK] Seq=297 Ack=69 Win=254 Len=1460      |
| 12  | 2.489866 | 10.19.49.130 | 10.19.49.131  | TCP      | 646    | 9088 → 51915 [PSH, ACK] Seq=1757 Ack=69 Win=254 Len=592 |
| 16  | 5.302883 | 10.19.49.130 | 10.19.49.131  | TCP      | 60     | 9088 → 51915 [PSH, ACK] Seq=2349 Ack=77 Win=254 Len=2   |
| 18  | 5.303067 | 10.19.49.130 | 10.19.49.131  | TCP      | 60     | 9088 → 51915 [PSH, ACK] Seq=2351 Ack=85 Win=254 Len=2   |
| 2   | 1.780802 | 10.19.49.131 | 172.217.7.202 | TLSv1.2  | 100    | Application Data  |
| 4   | 1.843088 | 10.19.49.131 | 172.217.7.202 | TCP      | 54     | 51947 → 443 [ACK] Seq=47 Ack=47 Win=258 Len=0           |
| 6   | 2.488617 | 10.19.49.131 | 10.19.49.130  | TCP      | 88     | 51915 → 9088 [PSH, ACK] Seq=1 Ack=1 Win=2053 Len=34     |

> [SEQ/ACK analysis]  
 > [Timestamps]  
 TCP payload (592 bytes)  
 Data (592 bytes)  
 Data: 202020202020206e444d333534333331202000009ad9c1...

```

0000 00 0c 29 c8 ab 9f 00 0c 29 f1 69 94 08 00 45 00  ..).....)i..E.
0010 02 78 79 72 40 00 40 06 47 e3 0a 13 31 82 0a 13  .xyr@.@.G...1...
0020 31 83 23 80 ca cb 70 9d d2 9d 78 96 10 ee 50 18  1.#...p...x...P.
0030 00 fe 6b d2 00 00 20 20 20 20 20 20 20 20 6e 44  ..k...      nD
0040 4d 33 35 34 33 33 31 20 20 00 00 9a d9 c1 3c 00  M354331 .....<.
0050 00 00 c1 12 00 00 80 00 00 00 00 0e 00 00 00 00  .....
0060 00 50 00 00 03 fa 00 00 9a d6 00 00 00 79 53 57  .P.....ySW
0070 20 63 6f 72 6e 65 72 20 6f 66 20 42 69 6c 74 6d  corner of Biltm
0080 6f 72 65 20 4d 61 6c 6c 20 20 20 20 20 20 20 20  ore Mall
0090 20 20 20 20 20 20 6e 53 32 32 39 34 32 20 20 20  ..nS 22942
00a0 20 00 00 9a d9 c1 46 32 00 00 c1 14 00 00 00 00  ....F2 .....
00b0 9a f1 00 0e 00 00 00 00 00 50 00 00 03 fb 00 00  .....P.....
00c0 9a d7 00 00 00 7a 63 6c 6f 73 65 64 20 74 69 6c  ....zcl osed til
00d0 20 6e 6f 6f 6e 20 4d 6f 6e 64 61 79 73 20 20 20  noon Mo ndays
00e0 20 20 20 20 20 20 20 20 20 20 20 20 20 6e 5a  ..nZ
00f0 35 35 37 30 39 20 20 20 20 00 00 9a dc c1 5a 00  55709 .....Z.
0100 00 00 c1 17 00 00 00 00 9a f1 00 0e 00 00 00 00  .....
0110 00 50 00 00 03 fc 00 00 9a d7 00 00 00 7b 65 78  .P.....{ex
0120 70 72 65 73 73 20 20 20 20 20 20 20 20 20 20 20  press
0130 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
  
```

Data (data.data), 592 bytes | Packets: 32 · Displayed: 32 (100.0%) · Dropped: 0 (0.0%) | Profile: Default

# Encryption Considerations

- Requires setup on both the server and clients
- Additional CPU overhead on both sides
- May not support old connections (CSDK prior to version 3.x, ADODB, etc)
- Certificates expire
- Larger key size is more secure but higher CPU usage

# What Supports SSL?

- ODBC, JDBC, and SQLJ connections
- DRDA and SQLI
- ESQLC
- dbaccess
- ER connections
- HDR connections
- Informix standard utilities
- Connection Manager
- Distributed queries
- PAM SSO

# IBM GSKit

- Primary utility to setup and manage encryption keys for Informix
- Ships with Informix CSDK and Server
- Provides libraries and utilities for SSL and TLS communications
- Used by Informix, DB2, and other IBM products
- Primary utility is gsk8capicmd (or gsk7capicmd if on a legacy system)

# Terminology

- Keystore– Small file-based database of certificates (public and/or private keys)
- Stash file – Small local protected file that contains password information to open password protected keystores
- Certificate – File that holds public key information

# Putting It All Together

1. Configure Server
2. Add SSL listener to sqlhosts
3. Create Server Keystore
4. Create Server Certificate
5. Create conssl.cfg file in \$INFORMIXDIR/etc
6. Create Client Keystore
7. Extract plain text public certificate from server keystore
8. Add Public Cert to Client Keystore
9. Test

# Configuring The Server

- Verify gskit is installed
- Adjust onconfig values
- Update sqlhosts
- Create the keystore and stash files
- Bring the listener online

# onconfig Changes

- `SSL_KEYSTORE_LABEL ifx_encrypt`
- `NETTYPE socssl,1,50,NET`
- `VPCCLASS encrypt,num=1`
- Add a new `DBSERVERALIAS` for ssl
  - `ifx_server_ssl`

# Update SQLHosts

ifx\_server\_ssl

onsocssl

server

port

# Setting Up Keystore

- All commands will be run in \$INFORMIXDIR/ssl
- If on a legacy system use gsk7capicmd in place of gsk8capicmd
- If on a 64 bit system the command will have \_64 at the end (gsk8capicmd\_64)
- In this example the DBSERVERNAME is ifx\_server
- The keystore label here is “ifx\_encrypt”
- The DBSERVERNAME must match the keystore and stash filename

# Create The Keystore

```
gsk8capicmd_64 -keydb -create -db \  
ifx_server.kdb -pw password -type cms -stash
```

- Flags

- keydb -create : Create a new keystore

- db :use the local database ifx\_server.kdb

- pw : set the password to the value

- type cms : Certificate type - we use cms for Informix

- stash : Stash the passwords with the files

# Create Server Cert

# Create server cert, the label needs to match the  
SSL\_KEYSTORE\_LABEL value

```
gsk8capicmd_64 -cert -create -db ifx_server.kdb \  
-stashed -label ifx_encrypt -size 2048 \  
-default_cert yes -expire 365 -dn "CN=ifx_server_ssl"
```

- -cert -create : create a new certificate
- -db ifx\_server.kdb : use that file for the database
- -stashed : read the stash file to get the password
- -label ifx\_encrypt : the label we defined in \$ONCONFIG
- -size 2048 : the size of the key pair

# Create Server Cert (cont.)

```
# gsk8capicmd_64 -cert -create -db ifx_server.kdb \  
-stashed -label ifx_encrypt -size 2048 \  
-default_cert yes -expire 365 -dn "CN=ifx_server_ssl"
```

- -default\_cert yes : this will be the default certificate
- -expire 365 : number of days for the certificate to be valid
- -dn "CN=ifx\_server\_ssl" : Unique name for this certificate, only CN= is required

# Configure Server (cont.)

- At this point you will have two files
  - ifx\_server.sth (stash)
  - ifx\_server.kdb (keystore database)
- Both need to have owner/permissions  
informix:informix 600

# Set Up Local Clients

# Create client keystore

```
gsk8capicmd_64 -keydb -create -db clikeydb.kdb \  
-pw password -type cms -stash
```

# Extract the public cert from the server keystore, write it to ifx\_server.cert (plain text)

```
gsk8capicmd_64 -cert -extract -db ifx_server.kdb \  
-format ascii -label ifx_encrypt -pw password \  
-target ifx_server.cert
```

# Add Certificate To Keystore

# Add server cert to the keystore

```
gsk8capicmd_64 -cert -add -db clikeydb.kdb \  
-stashed -label ifx_encrypt -file ifx_server.cert \  
-format ascii
```

# Client conssl.cfg

## **\$INFORMIXDIR/etc/conssl.cfg**

```
SSL_KEYSTORE_FILE    /opt/informix/ssl/clikeydb.kdb  
SSL_KEYSTORE_STH    /opt/informix/ssl/clikeydb.sth
```

# Server Final Steps

- Bring the engine up, or bring up the SSL listener with onmode -P
- Verify you can connect to the TCP ports via dbaccess
- Verify you can connect to the SSL ports via dbaccess
- Repeat the client keystore creation and cert import for any other UNIX clients

# Configuring Windows Client

- Create a directory where the keystore and the stash files can live
- This can be \$INFORMIXDIR/ssl
- For this example we will use c:\ssl

# Set Up consssl.cfg

- Enter the Informix Client SDK directory/etc
- If using more than one version of CSDK it needs to be in all of the etc directories
- Needs to contain
  - `SSL_KEYSTORE_FILE C:\ssl\clikeydb.kdb`  
`SSL_KEYSTORE_STH C:\ssl\clikeydb.sth`
- If using a directory with spaces it needs to use DOS formatting
  - `C:\progra~1\inform~1\etc`

# Generating Keydb (Windows)

- Copy the ifx\_server.cert file from the server to c:\ssl
- Run a command window as administrator
  - Open start menu
  - Type cmd
  - Right click on 'Command Prompt' choose 'Run as administrator'

# Generating Keydb (cont.)

# Add your gsk8\bin directory to your path if it is not already there

```
set PATH=%PATH%;c:\progra~1\ibm\gsk8\bin
```

```
cd c:\ssl
```

# Create a new client keydb as on UNIX

```
gsk8capicmd_64.exe -keydb -create -db clikeydb.kdb \  
-pw password -type cms -stash
```

```
gsk8capicmd_64.exe -cert -add -db clikeydb.kdb \  
-label ifx_encrypt -file ifx_server.cert -stashed \  
-format ascii
```

# Windows Connection

- Set up your ODBC connection as normal
- Make sure to use onsocssl and the dbserveralias value of the ssl listener
- Test your connection

# Other Notes

- You can have multiple servers certificates imported into in a client keyring allowing it to SSL access many systems
- You can reuse a client keyring between multiple client systems
- Make sure any users that need to connect can read from the keystore and stash files

# Alternative Options

- Informix CSM (Connection support modules)
- Permanent or on-demand VPNs
- SSH Tunnels
- SPWDCSM (simple password communication support module)
- Mixed environment
- Using a central CA rather than self signed certificates

# Questions?



Send follow-up questions to  
[info@advanceddatatools.com](mailto:info@advanceddatatools.com)

# Informix Webcasts from the IBM Champions at Advanced DataTools

- **Installing and Upgrading to the New Informix version 14 and using Informix HQ by Lester Knutsen** - Tuesday, April 30, 2019 at 2:00pm EDT
- **Informix Databases Migrations and Exports – Part 1 by Mike Walker** - Thursday, May 2, 2019 at 2:00pm EDT
- **Informix Databases Migrations and Exports – Part 2 by Mike Walker** - Thursday, June 6, 2019 at 2:00pm EDT

Registration and more information:

<https://advanceddatatools.com/Informix/NextWebcast.html>

# Informix Training

## Updated for Informix 14.XX

Attend classes online on the web, or in person at our training center in Virginia. All you need is a web browser to connect to our WebEx training system and an SSH client (like Putty) to connect to our training lab for hands-on exercises. Each student uses an 8-core Linux server, with 16GB RAM, SSD drives with Informix 12, and several large databases for benchmark exercises.

- **March 11-14, 2019 - Advanced Informix Performance Tuning**
- **April 22-25, 2019 - Informix for Database Administrators**
  - This course is for new database administrators, programmers, and technical support personnel who will be setting up, managing, and tuning IBM Informix databases.
- **September 16-19, 2019 - Informix for Database Administrators**
  - This course is for new database administrators, programmers, and technical support personnel who will be setting up, managing, and tuning IBM Informix databases.

➤ **More Information and Registration at:**

<http://www.advanceddatatools.com/Training/InformixTraining.html>

***Advanced DataTools***

# Informix Training Servers



Each Student in class will have a server running Informix 12.10 with:

- 8 CPU Cores
- 16 GB RAM
- 1 SSD Disk
- 1- 4 Disks

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