Safeguard your precious business data with the latest IBM i security enhancements

Thomas Barlen
barlen@de.ibm.com
Consulting IT Specialist
Power Systems Security

Agenda

- Observations & studies
- Base IBM i security enhancements
- Database security enhancements
- Cryptographic enhancements
- Network security enhancements

Agenda

- Observations & studies
- Base IBM i security enhancements
- Database security enhancements
- Cryptographic enhancements
- Network security enhancements

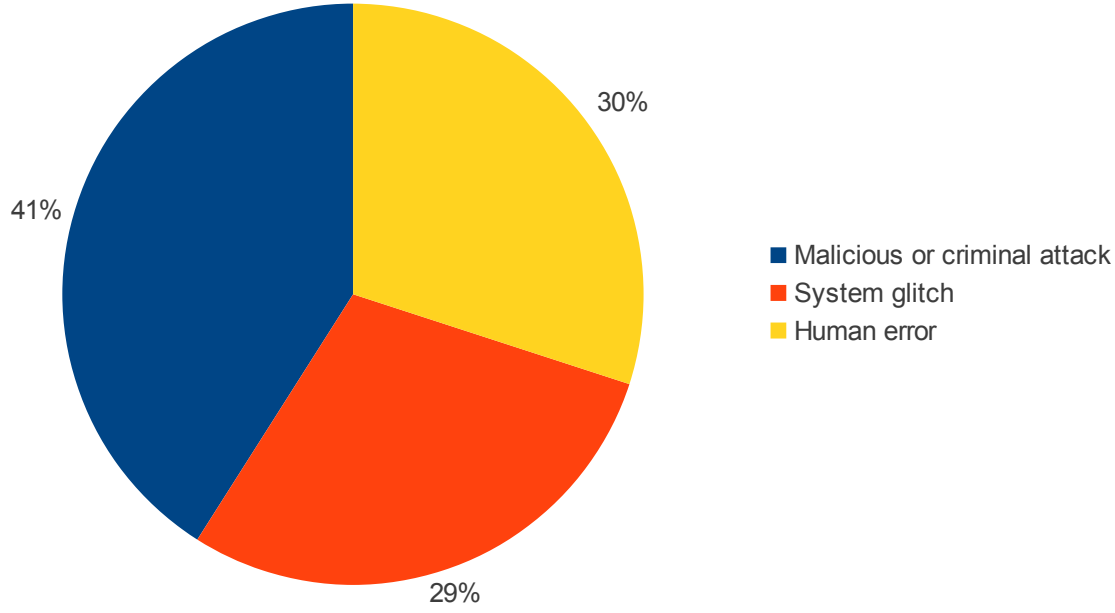
Observations & Studies

- Latest studies from the Ponemon Institute 2014 Cost of Data Breach: Global Analysis reveals:
  - *"Companies WW are finding that data breaches have become as common as a cold but far more expensive to treat"*
  - *"Average cost of a data breach to a company was $3.5 million in US dollars and 15 percent more than what it cost the previous year"*
  - *"Research reveals that reputation and the loss of customer loyalty does the most damage"*
  - *"In most countries, the primary root cause of the data breach is a malicious insider or criminal attack"*
  - *"Having a strong security posture, incident response plan and CISO appointment reduced the cost per record*

314 companies from 10 countries (United States, United Kingdom, Germany, Australia, France, Brazil, Japan, Italy, India, United Arab Emirates, and Saudi Arabia) participated in the study. The number of compromised records range from 2,415 to slightly more than 100,000.

Observations & Studies (cont'd)

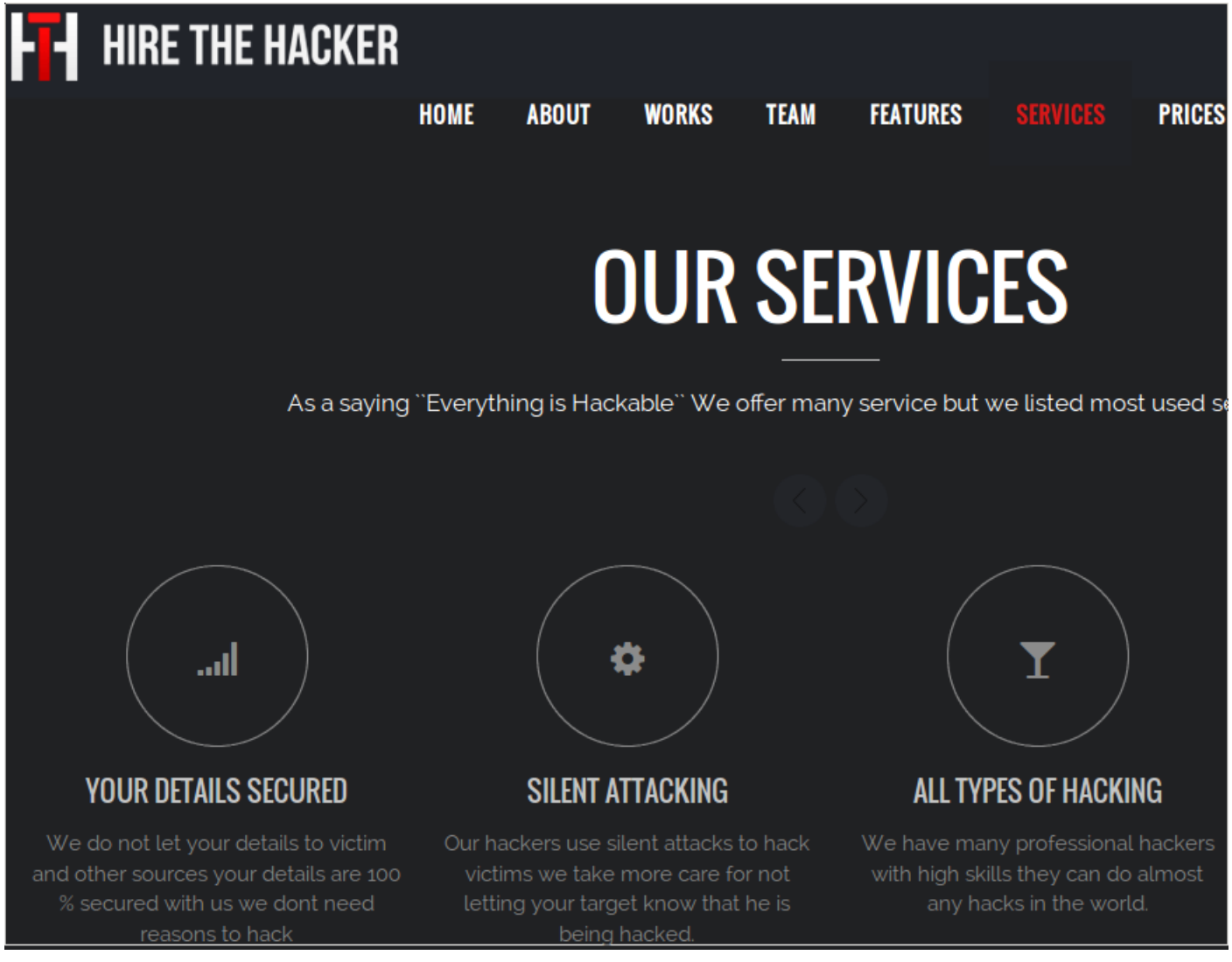
- Distribution of the root cause of the data breaches



- Companies are far more likely to have a small data breach than a mega breach

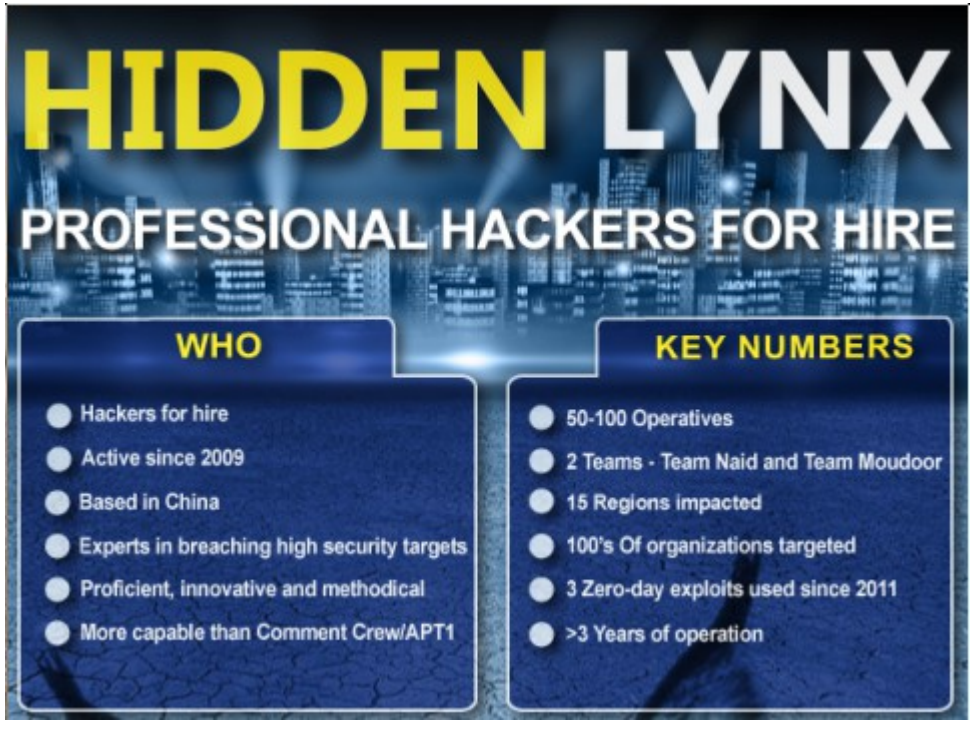
Your company could be the next target

- Many professional hacking services exist to hack into your company



Example:
http://hirethehacker.com/

Your company could be the next target (cont'd)

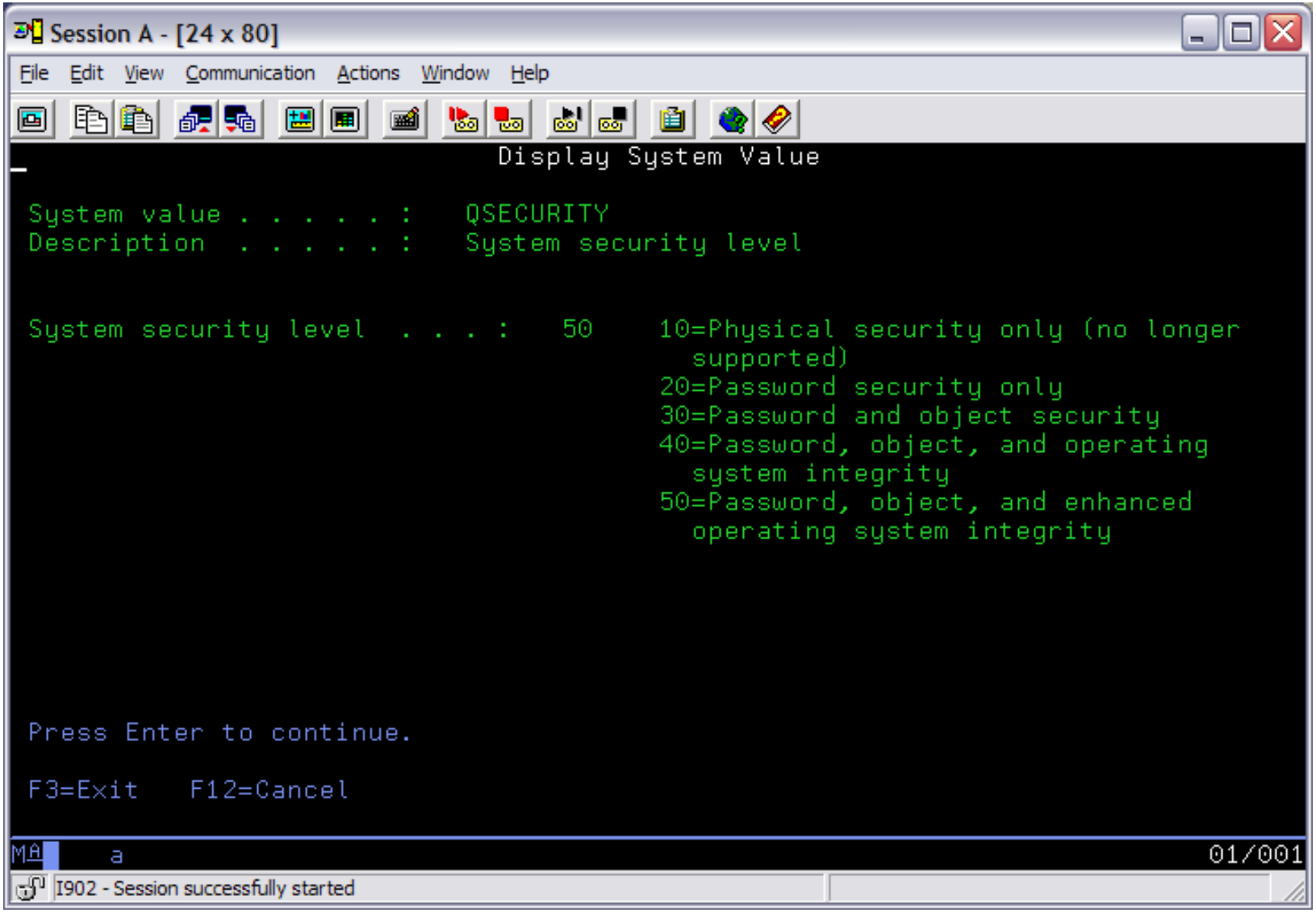


Agenda

- Observations & studies
- Base IBM i security enhancements
- Database security enhancements
- Cryptographic enhancements
- Network security enhancements

IBM i System Security

System Value: QSECURITY



Security Compliance – Password rule enhancements

Password Rule & User Profile Enhancements

- New system values supported (more...)
  - QPWDRULES, define new pwd rules
  - QPWDEXPWRN, define pwd expired warning interval
  - QPWDCHGBLK, prevent passwords from being changed repeatedly

- Changed system value
  - QLMTDEVSSN, Limit device sessions (*NONE, 1-9 sessions)

- Changed/New user profile parameters
  - LMTDEVSSN, Limit device sessions (1-9 sessions)
  - PWDCHGBLK - Block password change (1-99 hours)

Change Password (CHGPWD CL & API) 7.1

- Password syntax rules always apply when end users change their password (CHGPWD & QSYCHGPW API)

- Up to 7.1 System Administrators can use CRT/CHGUSRPRF to set a password to any value
- From 7.2
  - A new value *ALLCRTCHG for the QPWDRULES system value can also enforce password syntax rules for the CRT/CHGUSRPRF commands

  - 6.1: CP security audit record reflects a PWD that doesn't meet syntax rules

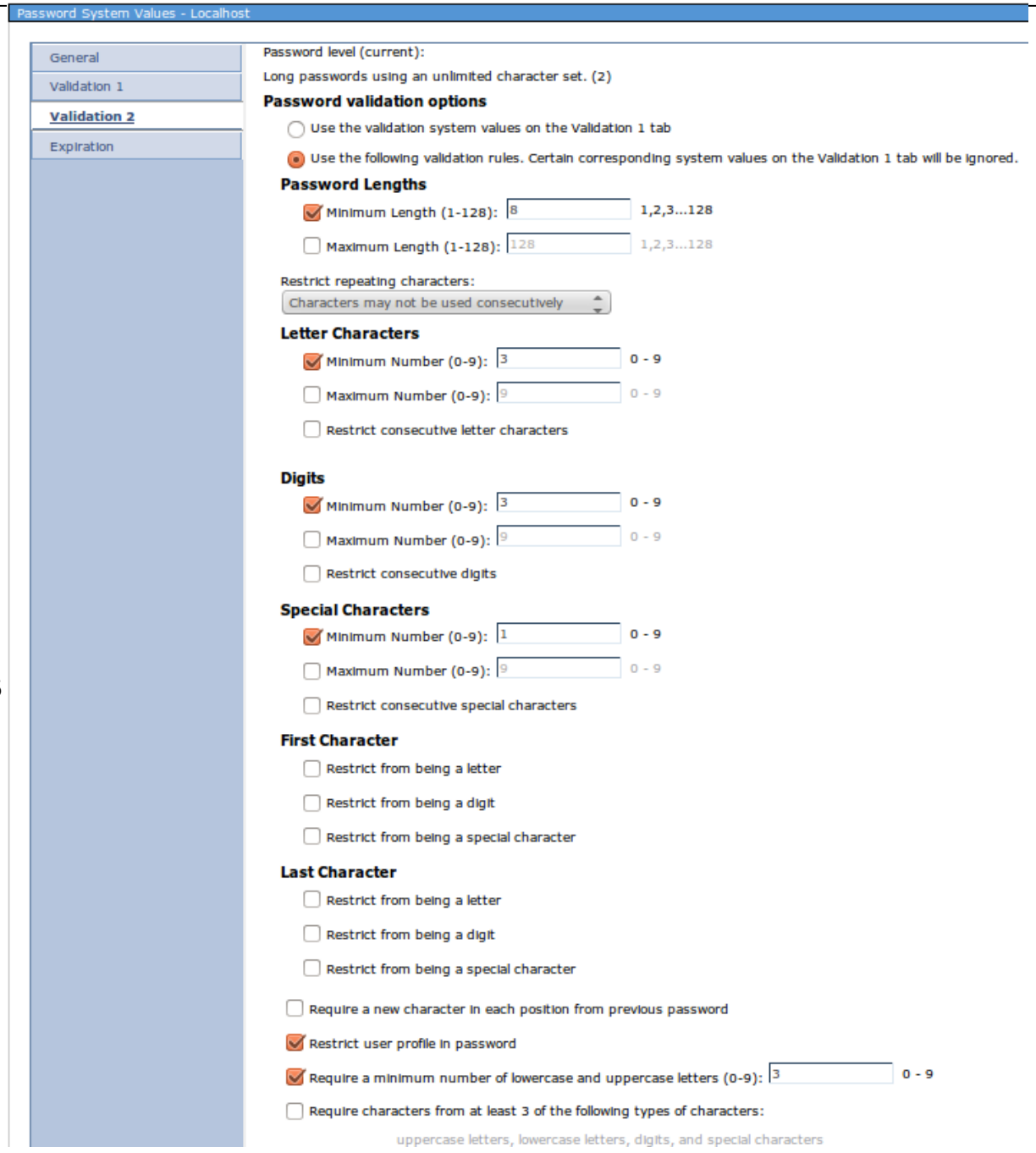
QPWDRULES – Password rules

- QPWDRULES - System value to define password syntax
  - QPWDRULES, define password rules
    - Require special character
    - Require mixed case
    - Prevent all numeric password
    - Require x number of digits
    - Require x number of letters
    - Require x number of special characters
    - Require characters of any 3 classes
    - Other supported values as well….

QPWDRULES Password rules

NOTE: Validation tab 1 are the password rules pre 6.1

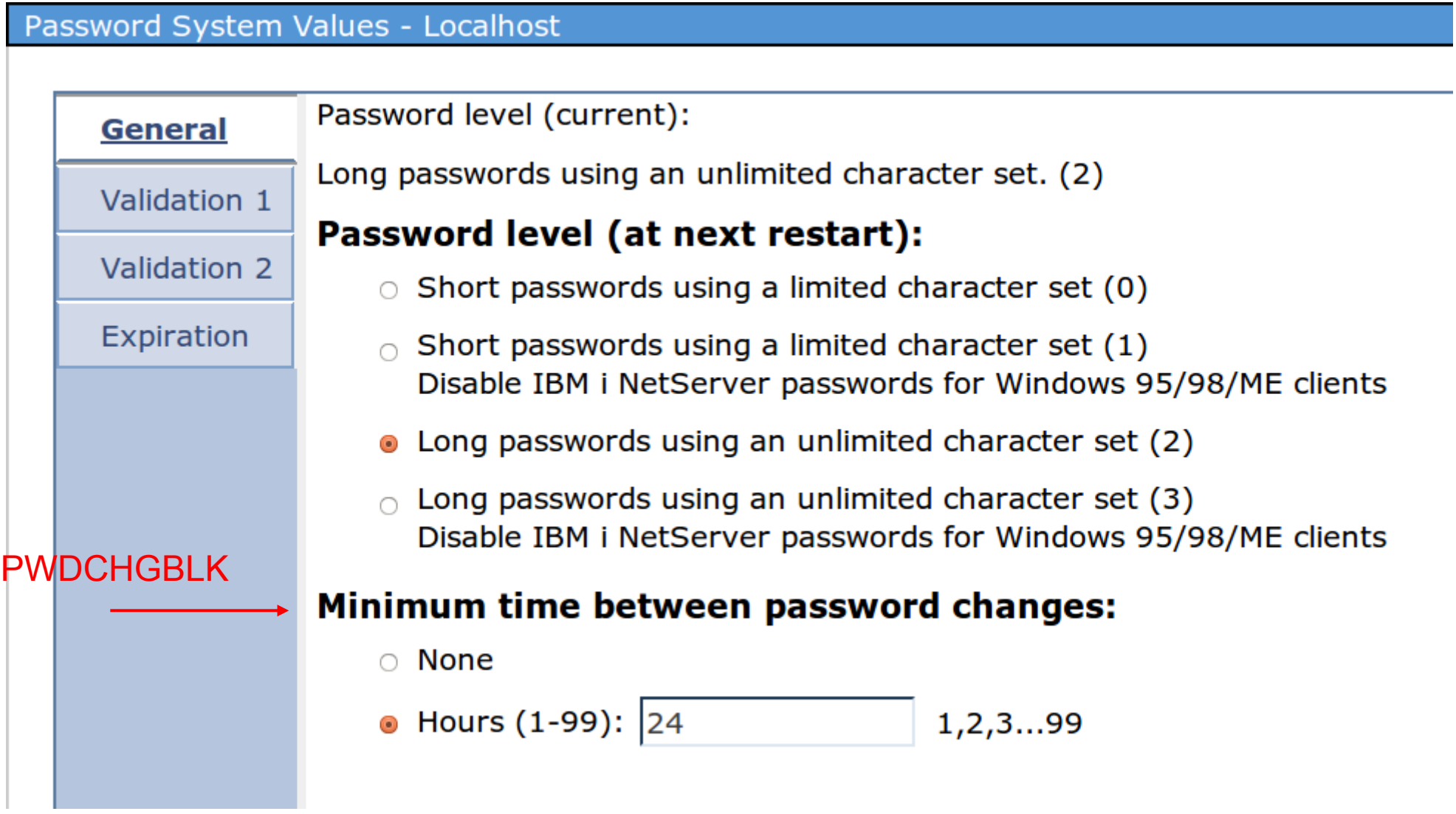
NOTE: Validation tab 2 are the combined password rules from 6.1 and higher



QPWDCHGBLK – Password Change Block

- QPWDCHGBLK - System value to prevent reuse of “prior” password
  - QPWDCHGDBLK, Block Password Change
    - Prevent change of password for x hours
      - *NONE
      - 1 to 99 hours
      - Recommendation is 24 hours
    - Password change block not in effect if PWDEXP(*YES) has been specified by the system administrator
    - PWDCHGBLK parameter added to the user profile

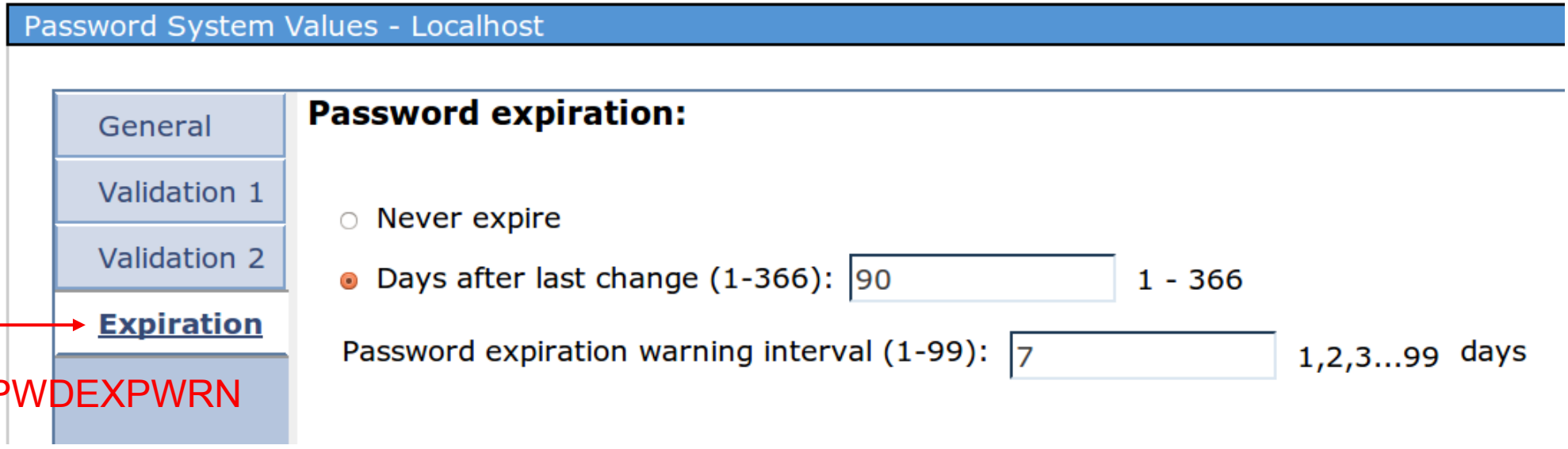
QPWDCHGBLK – Password Change Block



QPWDEXPWRN – Password expiration warning

- QPWDEXPWRN – Set password expiration warning interval
  - QPWDEXPWRN, Password Expiration Warning Interval
    - Warn user of expiring password
      - 7 is the Default
      - 1 to 99 days

QPWDEXPWRN – Password expiration warning

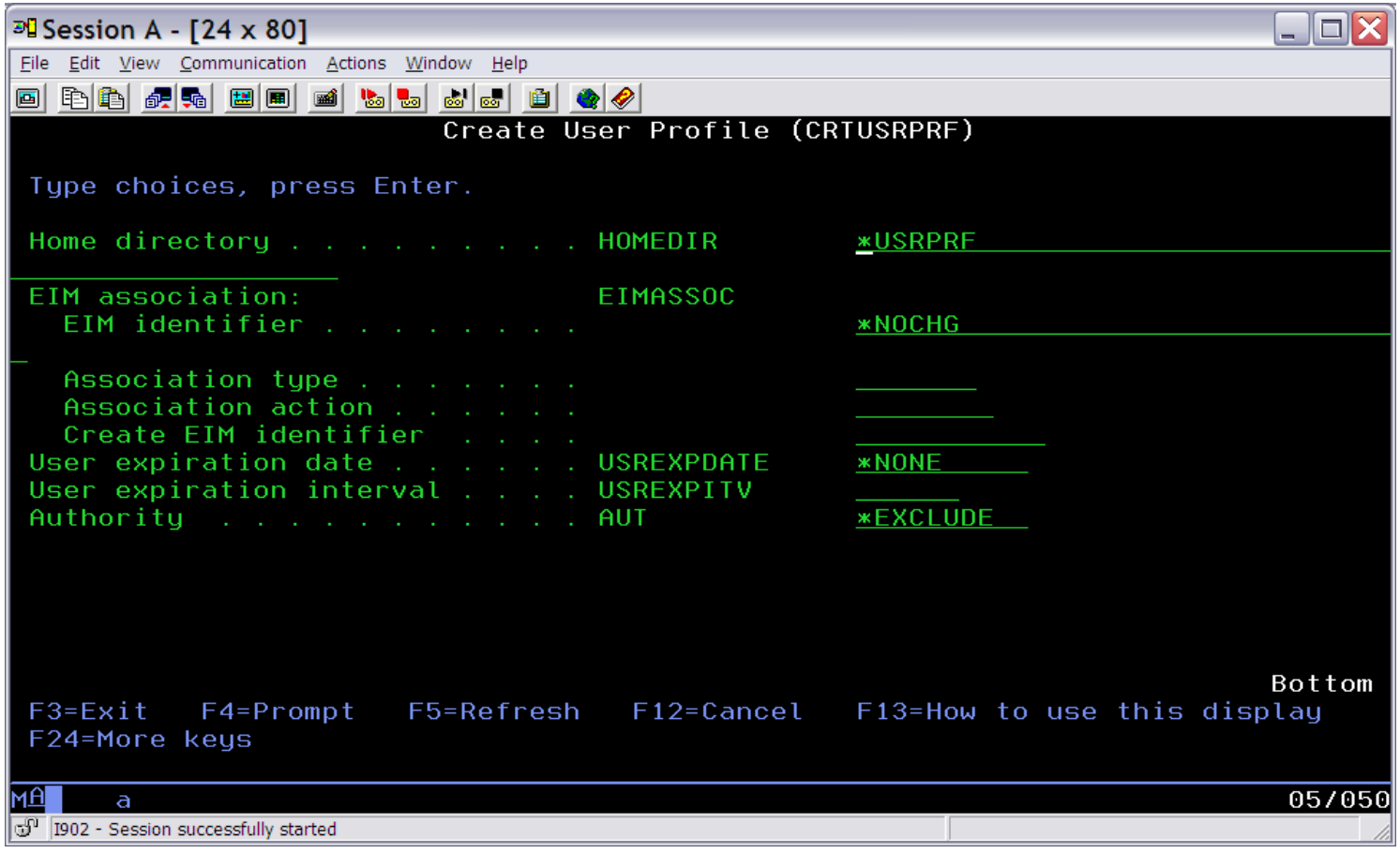


User Profile Enhancements (6.1)

- Additional information added to DSPUSRPRF
  - Password verifications not valid
  - Days before password expires
  - Creation Date
  - Change Date
  - Last used Date
  - Restore Date

New User Profile Parameters – 7.1

- New user profile “expiration” parameters in 7.1
  - USREXPDATE, User Expiration Date (Date when profile is *DISABLED)
  - USREXPITV, User Expiration interval (1-366 days)



Audit journal enhancements (5.4 / 6.1 / 7.1 / 7.2)

- CD entry format has been enhanced
  - CD entries are generated when command auditing is turned on
  - `CHGUSRAUD USRPRF(BARLEN) AUDLVL(*CMD)`

- CDCLP field in CD entry contains new values
  - N = Command run from a command line
  - Y = Command run within a compiled CL program
  - R = Command run from an interpreted REXX procedure **New**
  - E = Command run via Command Analyzer APIs (QCMDEXC, QCAPCMD, or QCAEXEC) **New**
  - B = Command is not being run from compiled CL or interpreted REXX or through a Command Analyzer API, and is in a batch job **New**
- Requires PTFs V5R4 (SI44854), 6.1 (SI44864), and 7.1 (SI44865)

Agenda

- Observations & studies
- Base IBM i security enhancements
- Database security enhancements
- Cryptographic enhancements
- Network security enhancements

Database Security Enhancements

- Business data is one of the most valuable assets in a company
- Sensitive data must be properly protected
  - Access control via object permissions
  - Encryption of sensitive data
  - Monitoring of unauthorized access attempts
  - Monitoring and control of read / write access over the network
  - Classification of data
- Most protection measures have been in IBM i for many years
- DB2 for IBM i provides new functions that can be used to implement
  - More granular access controls
  - Transparent encryption of data

Database Encryption

- IBM i provides several methods for encrypting data at rest
  - Common Cryptographic Architecture (CCA) APIs that use the 4765 cryptographic coprocessor
  - Cryptographic Services APIs
  - SQL encryption
- Using APIs to encrypt data within the business application requires changes to
  - Application code
  - Database column types and length
  - Interface changes for importing and exporting data
- New functions can be used to
  - Provide transparent encryption to applications
  - Data masking
  - Access control to data

7.1 IBM i DB2 Field Procedures

Column Level Encryption and Data Masking Enablement

DB2 Field Procedures – 7.1

- **DB2 Column Level (field) exit support**
  - Exit program (Field Procedure) called on insert/update/read of a column
  - Similar to “Triggers” but additional support to enable encryption
  - Exit added via SQL Alter Table
    - One exit per column

- **Enables Column Level Encryption**
  - Encrypt/Decrypt data in a DB2 column
    - No need to change column attributes like field length or data type
  - Encryption Key management must be implemented by the Exit Program (Field Procedure)

DB2 Field Procedures – 7.1

- **Data Masking support**
  - Depending on FieldProc controls, data can be masked during decoding
  - Example: User might just see last 4 digits of credit card PAN
    PAN: **** **** **** 1233
  - Special considerations when updating or inserting rows
    - Special return code specified in sqlstate parameter Field Encoding function

- **Field Procedure is a user written program**
  - Business partner solutions are available as well
  - Example: Patrick Townsend, Linoma

DB2 Field Procedures continued – 7.1

- **Additional Security Checks within the Field Procedure**
  - To make the support meaningful, additional security checks should be implemented by the exit
    - Is the user listed on the Authorization list (*AUTL)?
    - If so, decrypt the SS# (data), otherwise return '----------' or '000000000'

- **DB2 handles all length and data type issues**
  - I/O buffer doesn't change but encrypted data length and data type can change
    - I/O buffer for SS# is 9 and type character
    - Result of encryption is, for example, length 16 and data type binary
      - Managed by DB2 internally

Row and Column Access Control

Row and Column Access Control (RCAC) - 7.2

- Provides more granular access control to columns or rows depending on user/group
- Implemented in DB
- Controls access for all interfaces, i.e. native SQL, ODBC, FTP, etc.
- Row access
  - Returns only rows where a user has access to
- Column access
  - Masks data that a user does not has access to
- High-level privileged users such as *ALLOBJ users are not exempt from these rules

Implementation

- RCAC can be used to complement the table privileges model
- Implemented via SQL commands
- Alters a table and adds access controls for rows and columns
- Enforced via database engine

Custno	Name	City	Country	Revenue
33123	Star hotels	Mainz	DE	*******
44541	Super hotels	Athens	GR	*******
45211	Bakery No 1	London	GB	32223.33
66541	Golden Pub	Manchester	GB	787611.32
76112	BBQ Joint	Raleigh	US	*******

Row access control

- Limit access to rows based on accessing user or group membership

```
CREATE PERMISSION SALARY_ROW_ACCESS ON EMPLOYEE
   FOR ROWS WHERE VERIFY_GROUP_FOR_USER(SESSION_USER,
         'MGR','ACCGRP') = 1
   ENFORCED FOR ALL ACCESS
   ENABLE;

COMMIT;

ALTER TABLE EMPLOYEE
ACTIVATE ROW ACCESS CONTROL;

COMMIT;
```

Column access control

- Mask column values for users who do not have access

```
CREATE MASK SSN_MASK ON EMPLOYEE
   FOR COLUMN SSN RETURN
      CASE
       WHEN (VERIFY_GROUP_FOR_USER(SESSION_USER,'PAYROLL')
            = 1)
            THEN SSN
       WHEN (VERIFY_GROUP_FOR_USER(SESSION_USER,'MGR') = 1)
            THEN 'XXX-XX-' || SUBSTR(SSN,8,4)
         ELSE NULL
      END
   ENABLE;
COMMIT;

ALTER TABLE EMPLOYEE
   ACTIVATE COLUMN ACCESS CONTROL;
COMMIT;
```

Agenda

- Observations & studies
- Base IBM i security enhancements
- Database security enhancements
- Cryptographic enhancements
- Network security enhancements

IBM i **Software** Based Encryption

Encrypted ASP – Whole Disk Encryption

OS Option 45 (priced option)

Encryption of Data at Rest on disk (6.1)

- Meet **regulatory requirements** being imposed on our customers
- Reduce or eliminate the need for application providers to encrypt data
- Provide a more secure solution to help protect data
  - Key management done by the system

Disk level encryption

- **Encryption of data at rest**
  - Software solution
  - Both older, User ASPs, and newer, Independent ASPs are supported
  - Minimal key management requirements

- **Threats addressed by disk level encryption**
  - Protection of data in flight to SAN
  - Protection of data in flight in cross-site mirroring environment
  - Data Loss
    - Loss of disk drive
    - **Return drive to vendor (drive replacement of defective drive)**
      - **Single level store on IBM i does not eliminate the need to protect individual drives**

Implementation approach

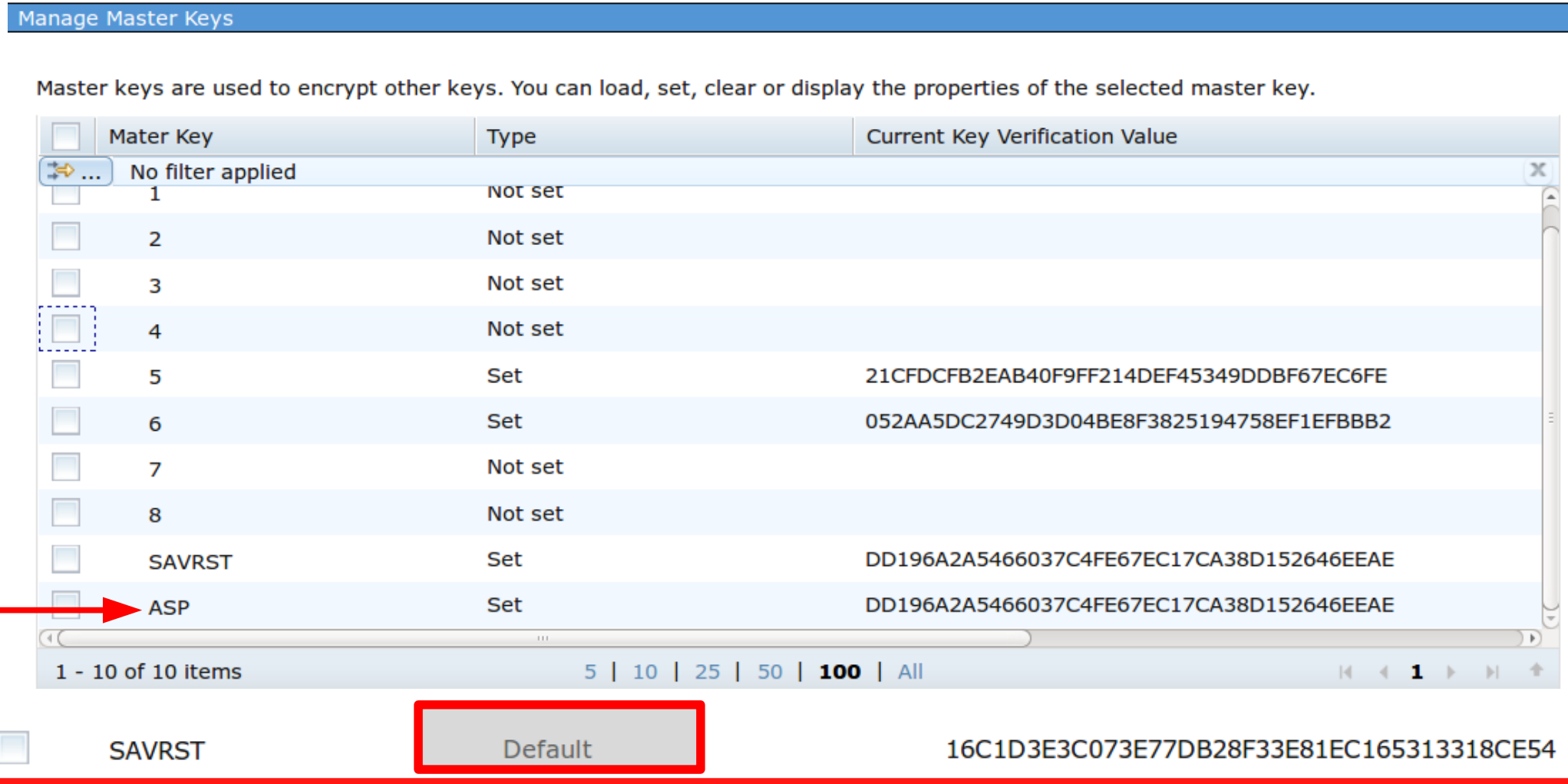
- **Provide the capability to encrypt all data residing on an ASP**

- Cryptographic keys will be stored in software but protected by "isolated" storage and master keys
  - **All data encryption keys are managed by the OS/LIC**
  - **The only key that needs to be managed by the customer is the <u>ASP master key</u>**

- **Minimal change required to an application**
  - ASP level changes may be required in the application to support independent ASPs (independent of encryption)

Create Master Key(s) via Navigator in 6.1

- Navigate to Security / Cryptographic Services Key Management / Master Keys

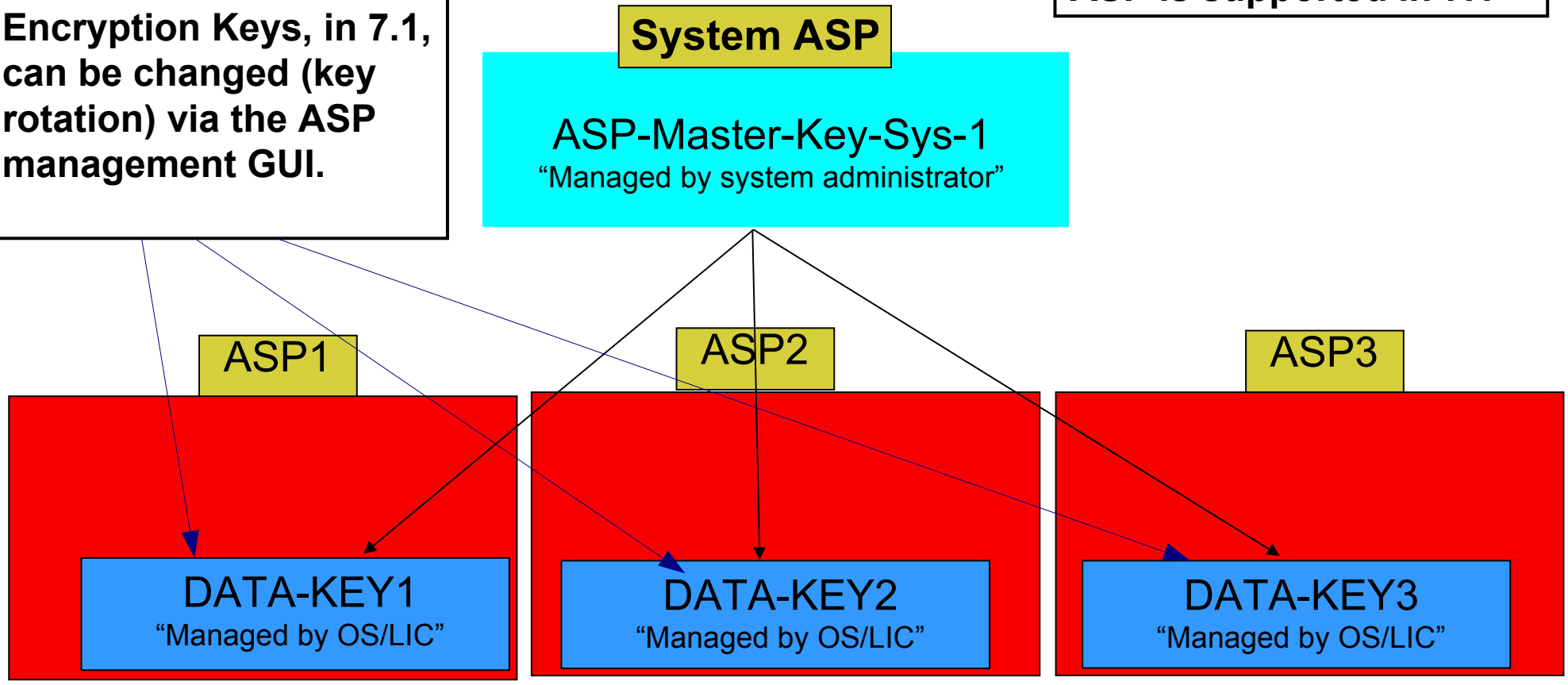


NOTE: The SAVRST Master Key is not yet set in the example above. A default key is in place to provide minimal protection until you set your key. This means that the master keys are not “in the clear” on your SAVSYS tape, but any IBM i system can decrypt them

ASP Key Management

The ability to turn on/off encryption on an existing ASP is supported in 7.1

Encryption Keys, in 7.1, can be changed (key rotation) via the ASP management GUI.



REQUIREMENT: ASP Master Key equal on all systems in cluster

Agenda

- Observations & studies
- Base IBM i security enhancements
- Database security enhancements
- Cryptographic enhancements
- Network security enhancements

Are you protected????

Don’t worry …

Simply plug in your IBM i

and it protects your data flawlessly

from any Network Access

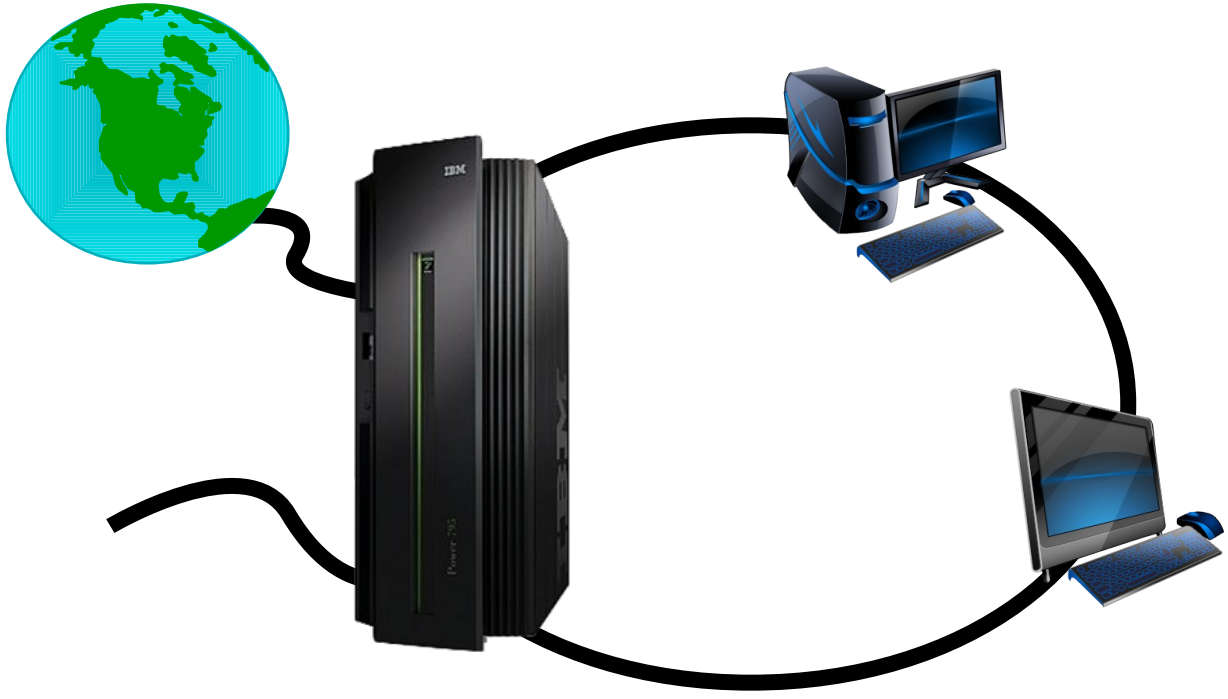
As long as your ‘network’ only has these …

For everyone else …

Network Servers are likely to be your single biggest threat

Activities that come through the TCP servers are NOT audited – you cannot tell who is downloading (or uploading), running SQL statements, or even executing remote commands

Some servers allow command functions and IGNORE a profile's 5250 command line restriction



New CL Command to load and unload IP filter

- Load/Unload IP Filter (LODIPFTR)
- Prior to the new command, filter had to be loaded and unloaded via IBM i Navigator
- Requires PTF SI47941 in V7R1

```
                    Load/Unload IP Filter (LODIPFTR)

Type choices, press Enter.

Option . . . . . . . . . . . . . . .          *LOAD, *UNLOAD
Line description . . . . . . . . . .          Name, *ALL
```

Transport Layer Security (TLS) V1.1 and V1.2 support added

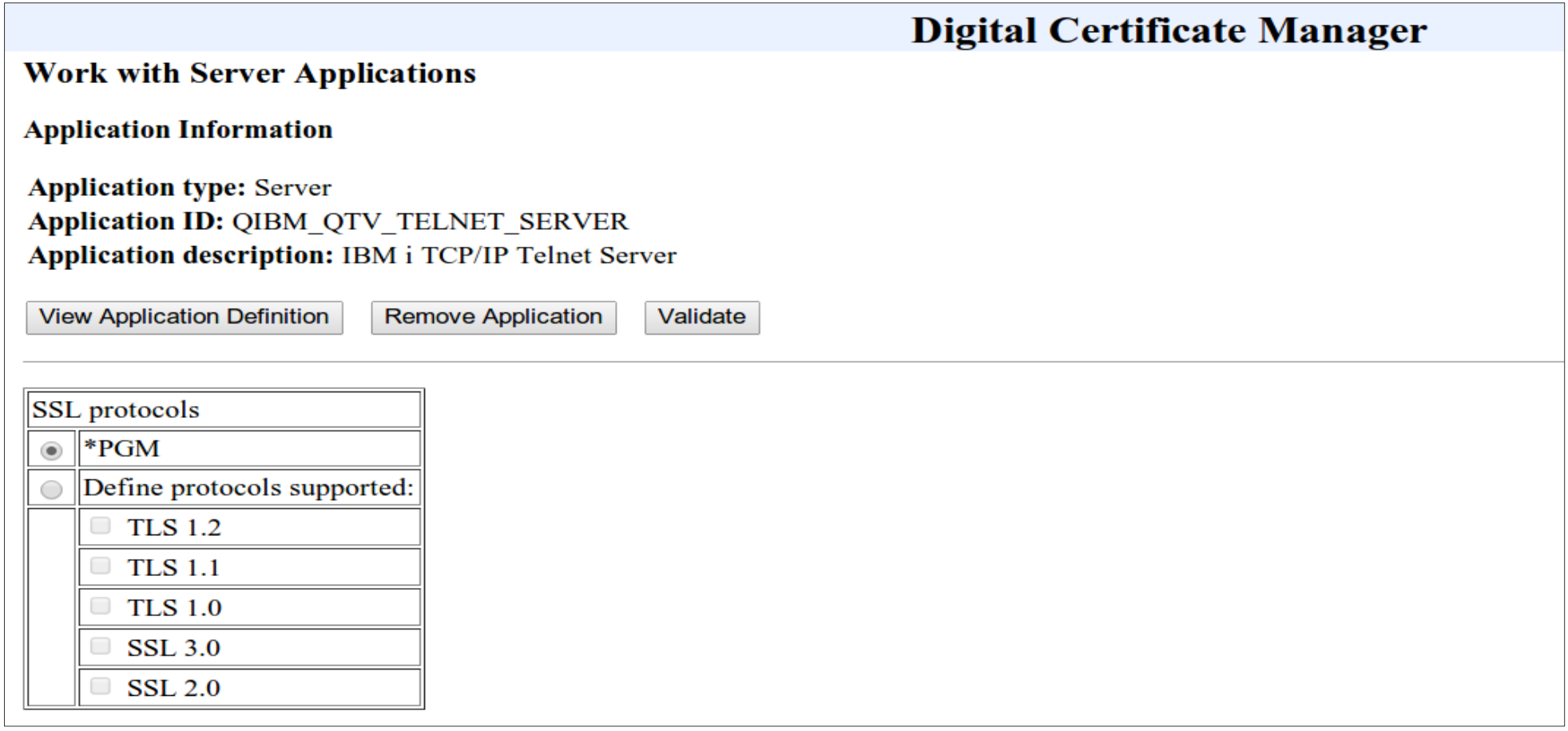
- Introduced with IBM i 7.1 TR6
- System-wide configuration via system value QSSLPCL

```
                          Change System Value

System value . . . . . :   QSSLPCL
Description  . . . . . :   Secure sockets layer protocols

Type choices, press Enter.

Protocols
*SSLV3
*TLSV1
*TLSV1.1
*TLSV1.2
```

New values not listed in help text

TLS V1.1 & V1.2 defined per SSL-enabled application in DCM

- Application settings



7.1 Networking Enhancements

With TR6 cipher suites for SSL-enabled applications can also be defined in DCM

- Application settings

SSL cipher specification options		
◉	*PGM	
○	Define cipher specification list:	Order
	RSA_AES_128_CBC_SHA256	1
	RSA_AES_128_CBC_SHA	2
	RSA_AES_256_CBC_SHA256	3
	RSA_AES_256_CBC_SHA	4
	RSA_3DES_EDE_CBC_SHA	5
	RSA_RC4_128_SHA	6
	RSA_RC4_128_MD5	Disable
	RSA_DES_CBC_SHA	Disable
	RSA_EXPORT_RC2_CBC_40_MD5	Disable
	RSA_EXPORT_RC4_40_MD5	Disable
	RSA_NULL_SHA256	Disable
	RSA_NULL_SHA	Disable
	RSA_NULL_MD5	Disable
	RSA_RC2_CBC_128_MD5	Disable
	RSA_3DES_EDE_CBC_MD5	Disable
	RSA_DES_CBC_MD5	Disable

SSL enabled TELNET Client

- 7.1 release plus PTFs back to 5.4
- Enables secure TELNET connections

```
                        Start TCP/IP TELNET (TELNET)

Type choices, press Enter.

Remote system  . . . . . .

Internet address . . . . . .

Port . . . . . .   *DFT          1-65534, *DFT
Secure connection  . . . . .   *ENVVAR       *ENVVAR, *YES, *NO
```

Environment variable: QIBM_TELNET_CLIENT_SSL 'Y'

Transport Security Extensions

- Socket APIs - exit support
- Exit support on the accept, connect and listen APIs to enable additional network security capabilities

```
                        Work with Registration Information

Type options, press Enter.
  5=Display exit point   8=Work with exit programs

                             Exit
     Exit                    Point
Opt  Point                   Format    Registered  Text
     QIBM_QSO_ACCEPT         ACPT0100     *YES     Exit point for APIs that accept
     QIBM_QSO_CONNECT        CONN0100     *YES     Exit point for sockets connect
     QIBM_QSO_LISTEN         LSTN0100     *YES     Exit point for sockets listen
```

Kerberos support for single sign-on

- Additional encryption algorithms supported
- RC4-HMAC, AES 128-bit, and AES 256-bit
  - Available via PTFs for V5R4, V6R1, and V7R1
- Steps to utilize new algorithms in an existing environment
  - Remove key table entries from IBM i key table and re-add them
  - Uncheck „DES Only“ option in Active Directory and change service account password
- IBM i Telnet client and FTP server/client have been enabled for SSO → V7R2

DASD Scrub – Delete data from Disk Drive (available – 5.4 and later)

New Product – PRPQ (5799-SD1)

- Initialize DASD – Department of Defense standard algorithm
- Removes data from DASD
- Requirement – Drive must be in working order

Special notices

This document was developed for IBM offerings in the United States as of the date of publication. IBM may not make these offerings available in other countries, and the information is subject to change without notice. Consult your local IBM business contact for information on the IBM offerings available in your area.

Information in this document concerning non-IBM products was obtained from the suppliers of these products or other public sources. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. Send license inquires, in writing, to IBM Director of Licensing, IBM Corporation, New Castle Drive, Armonk, NY 10504-1785 USA.

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

The information contained in this document has not been submitted to any formal IBM test and is provided "AS IS" with no warranties or guarantees either expressed or implied.

All examples cited or described in this document are presented as illustrations of the manner in which some IBM products can be used and the results that may be achieved. Actual environmental costs and performance characteristics will vary depending on individual client configurations and conditions.

IBM Global Financing offerings are provided through IBM Credit Corporation in the United States and other IBM subsidiaries and divisions worldwide to qualified commercial and government clients. Rates are based on a client's credit rating, financing terms, offering type, equipment type and options, and may vary by country. Other restrictions may apply. Rates and offerings are subject to change, extension or withdrawal without notice.

IBM is not responsible for printing errors in this document that result in pricing or information inaccuracies.

All prices shown are IBM's United States suggested list prices and are subject to change without notice; reseller prices may vary.

IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

Any performance data contained in this document was determined in a controlled environment. Actual results may vary significantly and are dependent on many factors including system hardware configuration and software design and configuration. Some measurements quoted in this document may have been made on development-level systems. There is no guarantee these measurements will be the same on generally-available systems. Some measurements quoted in this document may have been estimated through extrapolation. Users of this document should verify the applicable data for their specific environment.

Revised September 26, 2006

Special notices (cont.)

THANK YOU

IBM Systems Lab Services and Training

Our Mission and Profile

- Support the IBM Systems Agenda and accelerate the adoption of new products and solutions
- Maximize performance of our clients' existing IBM systems
- Deliver technical training, conferences, and other services tailored to meet client needs
- Team with IBM Service Providers to optimize the deployment of IBM solutions (GTS, GBS, SWG Lab Services and our IBM Business Partners)

Our Competitive Advantage

- Leverage relationships with the IBM development labs to build deep technical skills and exploit the expertise of our developers
- Combined expertise of Lab Services and the Training for Systems team
- Skills can be deployed worldwide to assure all client needs can be met

Europe Contacts

Virginie Cohen
VirginieCohen@fr.ibm.com
+33-4 -9211 41 33

Pierre Danze
pierre_danze@be.ibm.com
+32-2-339-5241