

Why Complex Passwords Should Be Fact and Not Fiction

Presented by Richard Faulhaber

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that provides education, professional networking and industry influence.

Complex Passwords - Fact and Not Fiction

Introduction: Who am I?

- A technical person with a creative background.
- Science and the arts.
- Eclectic education and interests.
- Chemistry Lab, Research, Libraries, Banking, IT/Office Management, Tech Support.
- Creative solutions to technical problems.
- Visualization of RACF Password Symbols paper.
- SHARE - San Antonio, 2016

Complex Passwords - Fact and Not Fiction

– Why is this relevant?

“Passwords are our most basic way of proving who we are to a computer. By implication, this is also how we control who can use our computer.”

- Stu Henderson

(source: The Mainframe Audit News, Issue 14, March 2010 - How to Think About Passwords and How to Think Deeply About Passwords

<http://www.stuhenderson.com/Mainframe%20Audit%20News/MANEWS14.pdf>)

Complex Passwords - Fact and Not Fiction

- Why is this relevant?
 - USERID or login name and passwords define us to the machines with which we work on a daily basis.
(There are OTHER ways to do this.)
 - Focus on mainframes.
 - Focus is on passwords – not password phrases.



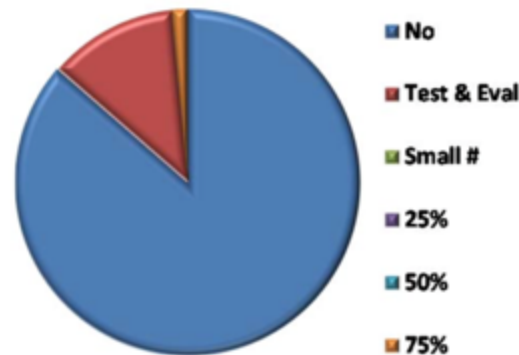
Complex Passwords - Fact and Not Fiction

Focus on Passwords
rather than Pass
Phrases?

Source: RSH Consulting
RACF Survey, Sept. '13.
(Survey #24)

Question:
Are you using RACF
Password Phrases?

Responses	Count	Percent %
No	57	86.4%
A few users have them for test and evaluation	8	12.1%
A small percentage of users are using them for logon authentication	0	0%
About 25% of the users are using them for logon authentication	0	0%
About half of the users are using them for logon authentication	0	0%
About 75% or more of the users are using them for logon authentication	1	1.5%
Total	66	100%

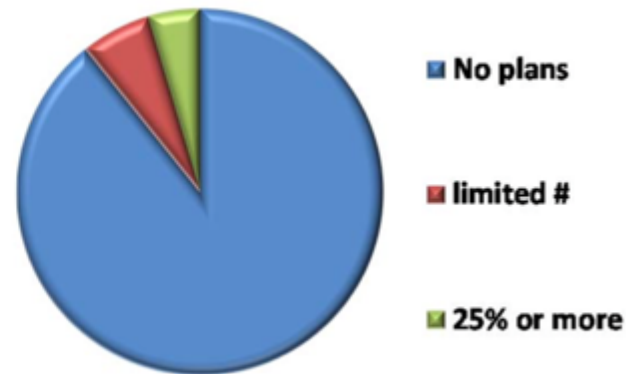


Complex Passwords - Fact and Not Fiction

Focus on Passwords
rather than Pass
Phrases?

Source: RSH Consulting
RACF Survey, Sept. '13.
(Survey #24)

Responses	Count	Percent %
No plans to implement	58	89.2%
Implement for a limited number of users	4	6.2%
Implement for 25% or more of all users	3	4.6%
Total	65	100%



Question:

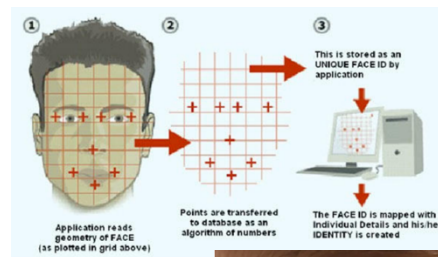
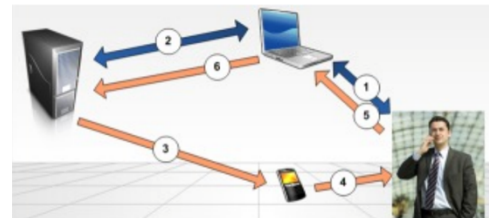
What are your plans for implementing Password Phrases?

Complex Passwords - Fact and Not Fiction

- New Technologies
 - Multi-Factor Authentication
 - Biometrics



What does the future hold?



Complete your session evaluations online at SHARE.org/SanAntonio-Eval

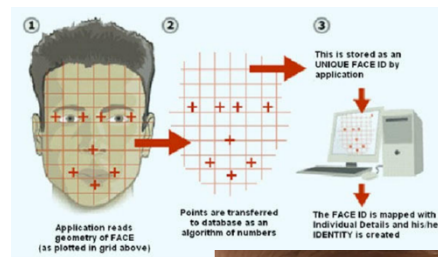
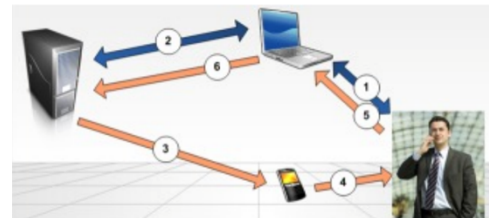
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Complex Passwords - Fact and Not Fiction

- New Technologies
 - Multi-Factor Authentication
 - Biometrics



something
you know



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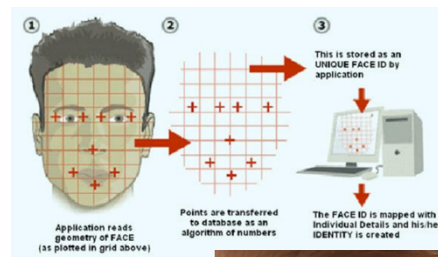
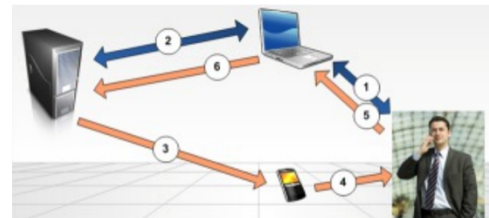
Complex Passwords - Fact and Not Fiction

- New Technologies
 - Multi-Factor Authentication
 - Biometrics



something
you **know**

something
you **have**

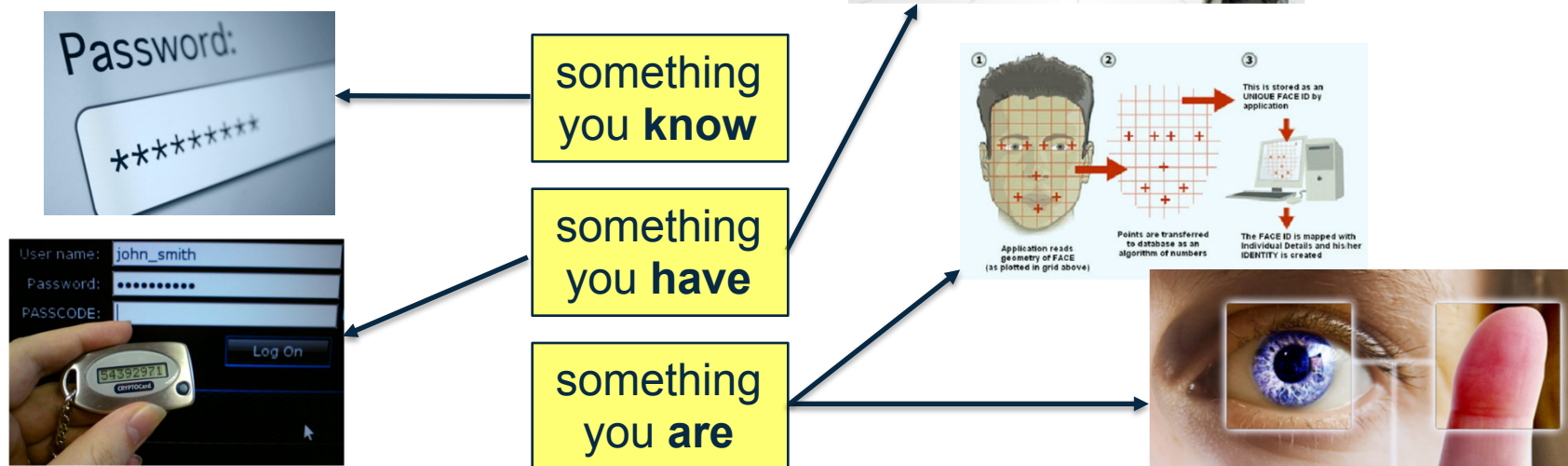


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Complex Passwords - Fact and Not Fiction

- New Technologies
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Complex Passwords - Fact and Not Fiction

- Defining Terms: Password Symbols
 - Any character or symbol available for use in crafting passwords.
 - Alphabet (upper / lower case), numbers, # \$ @ (national characters).
 - Additional special / user defined characters.

Complex Passwords - Fact and Not Fiction

- Defining Terms: Password Complexity
 - Number or symbol positions in the password.
 - Number of different symbols available for use.
 - Avoidance of certain patterns / recognizable words (dictionary lists, reserved word lists, etc...).
 - Avoidance of USERID or other personal user info.
 - Complies with complexity rules imposed by ESMs.

Complex Passwords - Fact and Not Fiction

- Defining Terms: Statistics (just a few examples)
 - 8-symbols, all numeric (repeats allowed) [10]
= 100,000,000 combinations
 - 8-symbols, upper case letters (repeats allowed) [26]
= 208,827,064,576 combinations
 - 8-symbols, upper/lower case letters, numbers, national characters (repeats allowed) [65]
= 318,644,812,890,625 combinations

Complex Passwords - Fact and Not Fiction

- Defining Terms: Statistics (just a few samples)
 - 8-symbols, upper/lower case letters, numbers, national characters, and RACF 14 Special Characters (repeats allowed) [79]
 $= 1,517,108,809,906,560$ combinations

For some perspective:

How tall is a stack of 1.5 quadrillion pennies?

A cracking program making a million guesses per second would take 48 years to test all combinations.

Complex Passwords - Fact and Not Fiction

- Defining Terms: Statistics (there is safety in numbers)

Eric Wedaa - Marist College

LongTail: FOSS ssh

Honeypot and Analytics

Software

<http://longtail.it.marist.edu/honey>

Length of password	Number of unique passwords
--------------------	----------------------------

1	99
---	----

2	1337
---	------

3	12145
---	-------

4	46013
---	-------

5	118317
---	--------

6	240858
---	--------

7	205774
---	--------

8	274723
---	--------

9	144392
---	--------

10	109426
----	--------

11	44478
----	-------

12	30716
----	-------

13	15984
----	-------

14	10815
----	-------

15	7324
----	------

16	4771
----	------

17	2299
----	------

8 characters used to be the maximum password length for unix.

Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

- Can help protect systems from unwarranted access.



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Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

- Systems with which we interact *SHOULD* have a number of safeguards in place to prevent unwarranted access.
- These are *OUTSIDE* the user's control. These safeguards fortify the WALLS of the kingdom.



Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

- The user's USERID and PASSWORD represent the KEYS to the kingdom.



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Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

- The user's USERID and PASSWORD represent the KEYS to the kingdom.

```
4/05 VIRI3 Level 1109 IP Address =  
VTAM Terminal =  
  
Application Developer System  
  
      // 0000000 SSSSS  
      // 00 00 SS  
SSSSSS // 00 00 SS  
SS // 00 00 SSSS  
SS // 00 00 SS  
SS // 00 00 SS  
SSSSSS // 0000000 SSSS  
  
System Customization - ADCC.2113.*  
  
====> Enter "LOGON" followed by the TSO userid. Example "LOGON INUSER" or  
====> Enter L followed by the APPLID  
====> Examples: "L TSO", "L CICST041", "L CICST042", "L IMS3270"
```



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Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

```
----- TSO/E LOGON -----  
  
Enter LOGON parameters below:          RACF LOGON parameters:  
  
Userid   ==>           New Password ==>  
  
Password ==>       Group Ident  ==>  
  
Procedure ==> ISPPPROC  
  
Acct Nmbr ==> ACCT#  
  
Size      ==> 250000  
  
Perform   ==>  
  
Command   ==>  
  
Enter an 'S' before each option desired below:  
          -Nomail          -Nonotice      S -Reconnect          -OIDcard  
  
PF1/PF13 ==> Help    PF3/PF15 ==> Logoff   PA1 ==> Attention   PA2 ==> Reshow  
You may request specific help information by entering a '?' in any entry field  
  
08/20  Fri 19 Feb 09 56
```



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Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

```
----- TSO/E LOGON -----  
  
ICH70001I ██████████ LAST ACCESS AT 09:06:20 ON WEDNESDAY, FEBRUARY 17, 2016  
IKJ56455I ██████████ LOGON IN PROGRESS AT 09:57:28 ON FEBRUARY 19, 2016  
IKJ56951I NO BROADCAST MESSAGES  
*****  
  
Acct Nmbr ==> ACCT#  
  
Size      ==> 250000  
  
Perform   ==>  
  
Command   ==>  
  
Enter an 'S' before each option desired below:  
      -Nomail      -Nonotice      S -Reconnect      -OIDcard  
  
PF1/PP13 ==> Help    PF3/PP15 ==> Logoff    PA1 ==> Attention    PA2 ==> Reshow  
You may request specific help information by entering a '?' in any entry field  
  
08/20
```



Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

- The USER (with a capital Y – O – U) holds the keys to the kingdom.



People are
the weakest
link...

Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

- A matter of professional and personal integrity.

Due diligence – “the care that a reasonable person exercises to avoid harm to other persons or their property”

- source: Merriam-Webster

Professional due diligence – the care that a professional exercises to avoid harm to company information (data) or property.

Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

- A matter of professional integrity:
 - You wouldn't leave a company laptop sitting on the front seat of your car, would you?



Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

- A matter of professional integrity:
 - So why be LAZY when it comes to your passwords?



Complex Passwords - Fact and Not Fiction

The argument FOR complex passwords:

- A matter of professional integrity: Don't be lazy!

123456

password

12345678

qwerty

12345

123456789

football

1234

1234567

baseball

welcome

1234567890

abc123

111111

1qaz2wsx

dragon

master

monkey

letmein

login

princess

qwertyuiop

solo

passw0rd

starwars

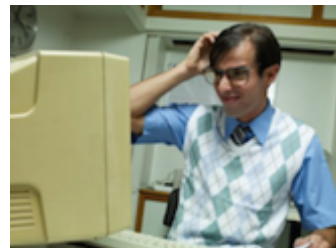


Twenty-five Worst Passwords of 2015.
(source: time.com)

Complex Passwords - Fact and Not Fiction

The arguments AGAINST complex passwords:

- Inconvenience to the user.
- Difficult to memorize – must be written down.
- Complexity is meaningless if a system's password store is compromised.
- Given enough time and resources, password cracking software can potentially hack into a password store in an offline attack.



Complex Passwords - Fact and Not Fiction

My answers to the arguments AGAINST complex passwords:

- **Inconvenience?** It's a fact of life. Professional integrity.
- **Difficult to memorize?** Use a system – mnemonics.
- **Compromised password store?** Not USER's responsibility.
- **Cracking software + time?** Change passwords regularly.



Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Tools already in place

- RACF, ACF2, Top Secret
- Available symbols
- Password Options



(set by ESM Administrator)

- What do the experts recommend?

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Tools already in place

- Default password symbol sets for RACF, ACF2, TSS:
 - A-Z (upper case alphabet)
 - 0-9 (numeric)
 - # \$ @ (national symbols)
 - With these [39] in place, you can generate 2.4 to 5.3 trillion unique combinations (difference due to allowance of repeated symbols)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Tools already in place

- Additional symbol sets (available if implemented):

- a-z (lower case alphabet)
- Special Characters

- RACF .<+|&!*-_%_>?:= [14 symbols]

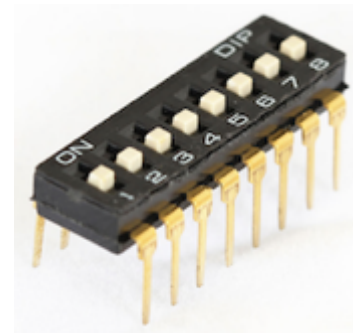
- ACF2 *&¬:=-!.%?_ [12 symbols]

- TSS &*^:=-!-%.?_ [12 symbols]

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Tools already in place

- Password Options (affecting which symbols may be used)
 - lower case symbols
 - special symbols
 - symbol sets (Rules / Masks)
 - reserved words/prefixes
 - user name, ID or other personal info
 - previous passwords



Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: RACF Password Options

- length (from 1 to 8 characters)
- RACF password enhancements

If implemented **and** enabled, additional special characters `.<+|&!*-%_>?:=` are allowed

- mixed case passwords
- previous password (and how many RACF remembers)



Crafting Complex Passwords: RACF Password Options

– Password Rules (from 1 to 8)

ALPHA -	(A-Z) (#\$@)
ALPHANUM -	(A-Z) (#\$@) (0-9)
NUMERIC -	(0-9)
VOWEL -	(AEIOU)
CONSONANT -	(BCDFGHJKLMNPQRSTUVWXYZ)
NATIONAL -	(#)\$@)
NOVOWEL -	(0-9) (#\$@) CONSONANTS
MIXEDNUM -	must have one of each (A-Z) (#\$@) (0-9) also (a-z) if enabled.

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: RACF Password Options

MIXEDVOWEL -	(AEIOU) also (aeiou) if enabled.
MIXEDCONSONANT-	(BCDFGHJKLMNPQRSTUVWXYZ) also (bcdfghjklmnpqrstvwxyz) if enabled.
MIXEDALL -	(#\$\$@) (0-9) (A-Z) also (a-z) and (.<+ &!*-%_>?:=) if enabled. Must have one of each category for multiple MIXEDALL positions.
SPECIAL -	(#\$\$@) also (.<+ &!*-%_>?:=) if enabled.
ANYTHING -	any symbol from any group stated above (only includes lower case and special characters if they are enabled).

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: ACF2 Password Options

- length (from 1 to 8 characters)
- special characters (.<+|&!*-%_>?:=)
- mixed case passwords
- may require at least one of each: alpha, numeric, upper case, lower case, national or user-defined
- cannot contain all numbers
- allows all vowels



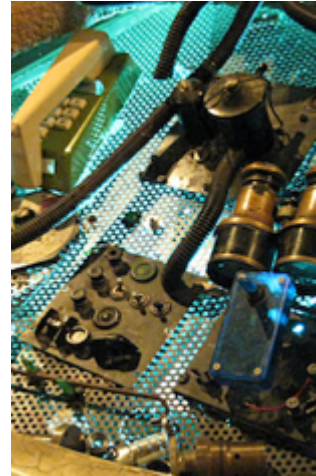
Crafting Complex Passwords: ACF2 Password Options

- check number of consecutive characters (like 345 or XYZ)
- previous password (and how many ACF2 remembers – up to 64 previous passwords)
- checks number of consecutive similar symbols between old and new passwords
- checks for logon ID in password
- checks number of consecutive characters to match user name in password

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: TSS Password Options

- length (from 4 to 8 characters)
- special characters (&*^:=!-%.?_|)
- mixed case passwords
- may require at least one of each: alpha, numeric, upper case, lower case, special character, special character (not in first or last position)
- must contain all numbers
- no vowels allowed



Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: TSS Password Options

- restricts number of pairs of repeated characters
- cannot contain user's ACID or any word of the ACID name
- initial characters cannot match prefix entries in the Restricted Password List
- restricts use of words in RPL
- does not allow password similar to previous password

Crafting Complex Passwords: TSS Password Options

- may impose a mask – requires specific symbol types per each position in a password:
 - a – alphabetical character
 - v – vowel
 - c – consonant
 - x – non-vowel (including national characters)
 - ? – any character

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Tools already in place

Symbol Combination Statistics - **Safety in Numbers**

- Formula $N*N*N*N*N*N*N*N$ or N^P
- 8 positions, (A-Z) (a-z) (0-9) (#\$@)
 - 318 trillion combinations (203 trillion, no repeats)
- 8 positions, (A-Z) (a-z) (0-9) requires 2 x (#\$@)
 - 678 billion combinations (356 billion, no repeats)

```
17574672890977777279380008164706001614:  
1922218427255025425688767179049460165:  
1221066118630674427862203919494504712:  
1940772671947826848260147699090264013:  
5868386894277415599185592524595395943:  
5855584840635342207222582848864815845:  
5109659609402522887971089314566913686:  
7047755513237964145152374623436454285:  
1744780847848968332144571386875194350:  
1894090718649423196156794520809514655:
```

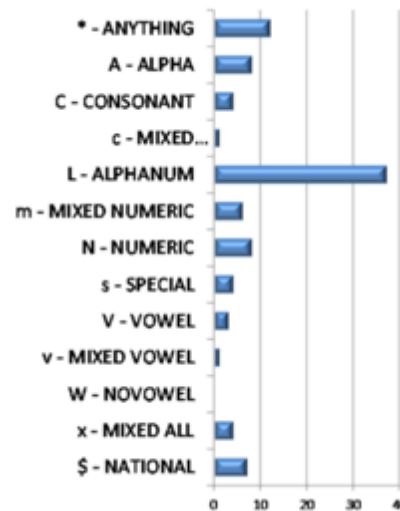
Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: RSH Consulting Survey

RSH Consulting survey symbols are in common use.

Looking at all your
RULEs collectively,
which of the following
character types have
been specified?

Responses	Count	Percent %
* - ANYTHING	12	22.2%
A - ALPHA	8	14.8%
C - CONSONANT	4	7.4%
c - MIXED CONSONANT	1	1.9%
L - ALPHANUM	37	68.5%
m - MIXED NUMERIC	6	11.1%
N - NUMERIC	8	14.8%
s - SPECIAL	4	7.4%
V - VOWEL	3	5.6%
v - MIXED VOWEL	1	1.9%
W - NOVOWEL	0	0%
x - MIXED ALL	4	7.4%
\$ - NATIONAL	7	13.0%
Total	54	



(source: http://rshconsulting.com/surveys/RSH_Consulting__RACF_Survey_049__Password_Rules.pdf)

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Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Expert Recommendations

- Auditing Essentials – Volume 2
 - Taming RACF – SETROPTS
 - Mastering CA ACF2 – GSO
 - Controlling CA Top Secret
- Includes Defense Information Systems Agency's Security Technical Implementation Guides (DISA STIGs)
- DOD recommendations



By Julie-Ann Williams, Mark Underwood, Craig Warren.

(<http://www.newera-info.com/eBooks.html>)

Crafting Complex Passwords: RACF - Experts Recommend

- 8 character length (AE2, DOD, DISA STIG)
- requires at least one special characters (AE2, DOD, DISA STIG)
- allow for mixed case (AE2, DISA STIG)
- password history should be 10 or higher (DISA STIG)
- rules: (DOD recommendations)
 - 8 character length
 - mix of alpha, numeric, special (at least one of each)
 - no repeated / no consecutive characters (req exit)
 - no user info in password (req exit)

Crafting Complex Passwords: RACF - Experts Recommend

– DISA STIG for Secure RACF Implementation

RULE 1 LENGTH(8) \$mmmmmmm

RULE 2 LENGTH(8) m\$mmmmmm

RULE 3 LENGTH(8) mm\$mmmmmm

RULE 4 LENGTH(8) mmm\$mmmm

RULE 5 LENGTH(8) mmmm\$mmm

RULE 6 LENGTH(8) mmmmm\$mm

RULE 7 LENGTH(8) mmmmmm\$m

RULE 8 LENGTH(8) mmmmmmm\$

All passwords 8 characters long with one national symbol, all others mixed numeric.

WHAT IF?... Modularity...more control over rules... userid or group specific...

Crafting Complex Passwords: ACF2 - Experts Recommend

- password length 8 characters (AE2, DOD, DISA)
- requires at least one alpha, numeric, special character (AE2, DOD, DISA STIG)
- requires at least one upper case (DISA STIG)
- requires mixed case (DISA STIG)
- LID not allowed in password (AE2, DOD, DISA STIG)
- restrict use of user's name (DISA STIG – 4 char)
- password cannot be all numeric (DOD & DISA STIG)
- consecutive repeated chars not allowed (AE2, DOD, DISA STIG)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: ACF2 - Experts Recommend

- special characters (#\$@) (AE2, DOD, DISA STIG)
- cannot begin with reserved word prefix (DISA STIG)
- compares new and old passwords (DISA STIG (3))
- allows vowels (AE2, DISA STIG)
- enable password history (AE2, DISA STIG (10 – 64))

Crafting Complex Passwords: TSS Expert Recommends

- 8 character length (AE2, DOD, DISA STIG)
- repeated characters not allowed (DOD, DISA STIG)
- no consecutive characters (DOD only)
- cannot contain user ACID or any word of ACID NAME (DISA STIG)
- checks similarity of previous passwords (DISA STIG)
- requires at least one of each: alpha, numeric, special character (in PASSCHAR control option - minimum #\$\$@) (DOD, DISA STIG)

Complex Passwords - Fact and Not Fiction

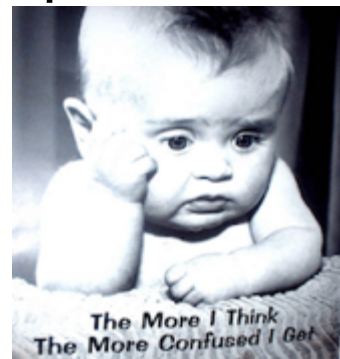
Crafting Complex Passwords: TSS Expert Recommends

- requires at least one upper and one lower case (DOD, DISA STIG)
- initial characters cannot match prefix entries in the Restricted Password List (DISA STIG)
- Cannot contain user ID, name, phone number or standard dictionary word (DOD, DISA STIG)
- enable password history (AE2, DISA STIG (10 or more))

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Expert Recommends

“...you can end up making the new password rules SO complex it can be a virtual impossibility **for a standard issue human being** to come up with a new password that fits those rules.”



(source: z/Auditing Essentials - VOLUME 2 – For CAACF2 -

Julie-Ann Williams, Mark Underwood, Craig Warren <http://www.newera-info.com/eBooks.html>)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Tools the user brings

- Professional and personal integrity.

- Intelligence – with smarts,
you can be clever, too.

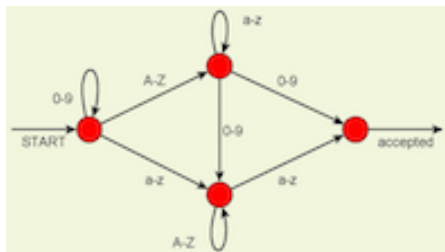
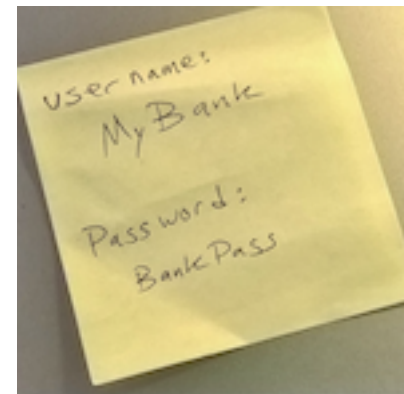
- A system for crafting complex
passwords.



Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: A system

- Rule of thumb:
 - Don't be LAZY)
 - Don't go CRAZY



Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: A system

- Mnemonics vs Words
 - Can foil a dictionary or reserved word attack
 - Personal: easy to remember, difficult to guess
- Substitution of symbols and numbers for letters words
 - @ for a, # for H, \$ for S
 - 7 for L, 1 for i or l, 8 for B

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: A system

- Rhythmic element – to further obscure the mnemonic
 - The rhythm element is imposed on the password by which keystrokes are SHIFT-ed and which are not.
 - Remember the keystrokes and the rhythmic element.



Complete your session evaluations online at SHARE.org/SanAntonio-Eval

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Complex Passwords - Fact and Not Fiction

Available symbols: SHIFT-able keys



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Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: A system

Sample passwords created by this method:

dQ6Fj@1C

DYkt#T4j

1lMHi\$Fc

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Mnemonic with swap & rhythm

SOURCE: do quick brown foxes jump around lazy cats?

MNEMONIC: D Q B F J A L C

MNEMONIC: DQBFJALC [LEVEL 1]

SWAP: DQ6FJ@LC [LEVEL 2]

RHYTHM: .|.|.|.|

PASSWORD: dQ6Fj@lC [LEVEL 3]



(contains upper/lower case, numeric, special symbols)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Mnemonic with swap & rhythm

SOURCE: Do you know the way to San Jose

MNEMONIC: D Y K T W T S J

MNEMONIC: DYKTWTSJ [LEVEL 1]

SWAP: DYKT3T\$J [LEVEL 2]

RHYTHM: ||..||..

PASSWORD: DYkt#T4j [LEVEL 3]



(contains upper/lower case, numeric, special symbols)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: Mnemonic with swap & rhythm

SOURCE: I left my heart in San Fran cisco

MNEMONIC: I L M H I S F C

MNEMONIC: ILMHISFC [LEVEL 1]

SWAP: ILMH1\$FC [LEVEL 2]

RHYTHM: ..|||.||.

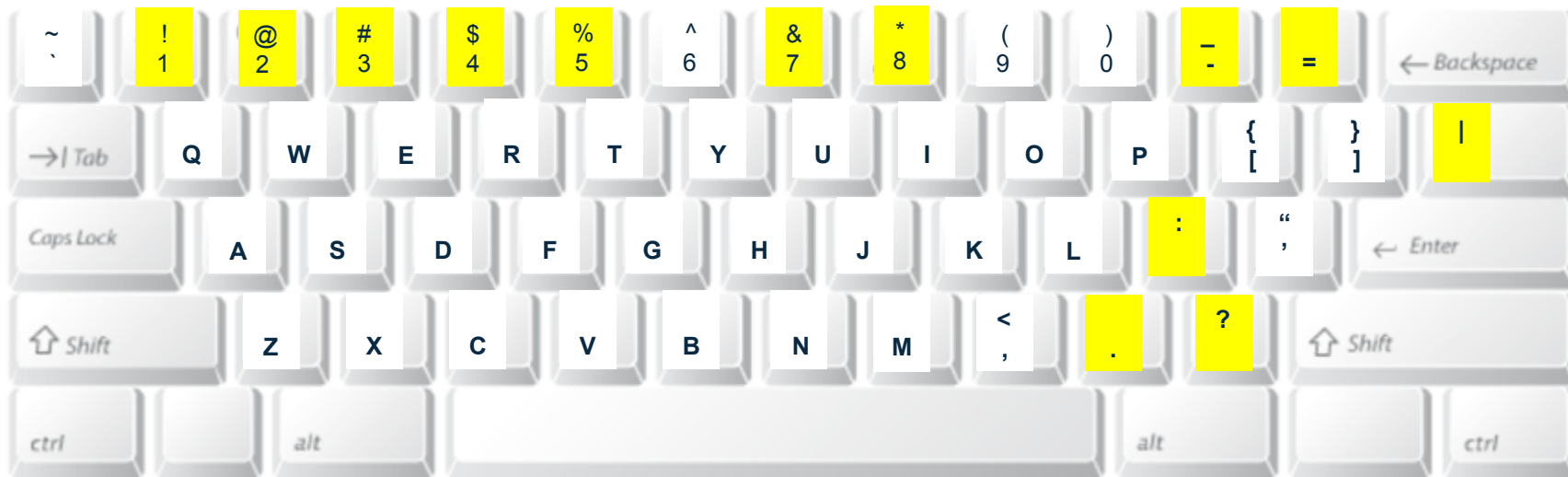
PASSWORD: i1MH1\$Fc [LEVEL 3]



(contains upper/lower case, numeric, special symbols)

Complex Passwords - Fact and Not Fiction

Available symbols: SHIFT-able keys (ACF2 special symbols)



NOT symbol - PC: alt + 0172 Mac: option + L



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Complex Passwords - Fact and Not Fiction

Available symbols: SHIFT-able keys (TSS special symbols)



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Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: RACF – special characters

SOURCE: Great minds think alike. Not so! Be unique.

MNEMONIC: G M T A N S B U

MNEMONIC: GMTANSBU [LEVEL 1]

SWAP: G3T@N5BU [LEVEL 2]

RHYTHM: | . | . | | . .

PASSWORD: G3T2N%bu [LEVEL 3]



(contains upper/lower case, numeric, special symbol)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: ACF2 – special characters

SOURCE: Ada Lovelace wrote programs well before their time

MNEMONIC: A L W P W B T T

MNEMONIC: ALWPBTT [LEVEL 1]

SWAP: A73PWB+T [LEVEL 2]

RHYTHM: .|.|.|.|

PASSWORD: a&3PwB=T [LEVEL 3]



(contains upper/lower case, numeric, special symbols)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: TSS – special characters

SOURCE: Some rabbits love carrots stolen from my garden

MNEMONIC: S R L ^ S F M G

MNEMONIC: SRL^SFMG [LEVEL 1]

SWAP: 5RL^\$F3G [LEVEL 2]

RHYTHM: .|.|.|.|

PASSWORD: 5Rl^4F3G [LEVEL 3]



(contains upper/lower case, numeric, special symbols)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: TSS – special characters

SOURCE: Chicken cross the road? Get to other side.

MNEMONIC: C C T R G T O S

MNEMONIC: CCTRGTOS [LEVEL 1]

SWAP: C{TRG2OS [LEVEL 2]

RHYTHM: ||. ||. |.

PASSWORD: C{tRG2Os [LEVEL 3]



(contains upper/lower case, numeric, special symbols)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: RACF – special characters

SOURCE: This is me %. How do I look?

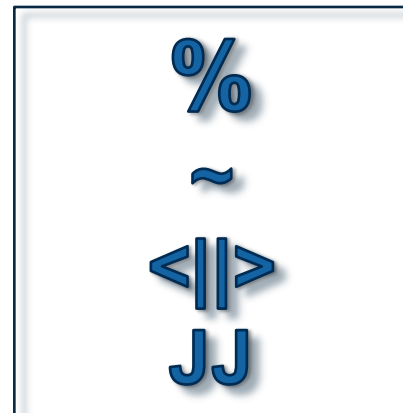
MNEMONIC: T I M % H D I L

MNEMONIC: TIM%HDIL [LEVEL 1]

SWAP: +I3%#D1L [LEVEL 2]

RHYTHM: .|.||||.

PASSWORD: =I3%#D!l [LEVEL 3]



(contains upper/lower case, numeric, special symbols)

Complex Passwords - Fact and Not Fiction

Crafting Complex Passwords: RACF – special characters

SOURCE: USA rocket ship emoji

PASSWORD: <1U%\$*@=



(contains upper/lower case, numeric, special symbols)

Complex Passwords - Fact and Not Fiction

Closing:

- Security Administrators fortify the walls of the castle.
- The USER holds the keys to the kingdom:
 - Protect your user ID and password (and rules).
 - Come up with a system to craft complex passwords.
 - Change passwords regularly.
 - If you must write them, obscure them, keep them safe.

Complex Passwords - Fact and Not Fiction



Why Complex Passwords Should Be Fact and Not Fiction

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