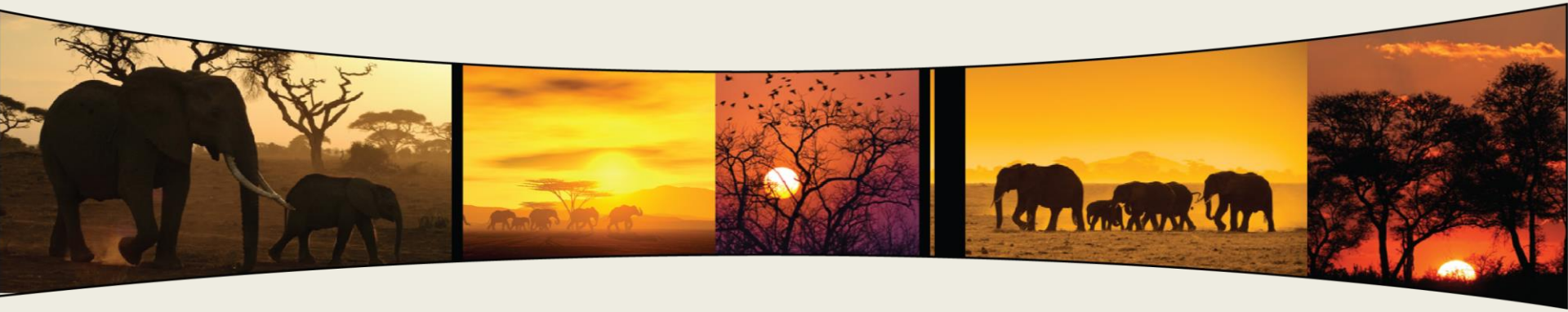


Pulling the Trigger

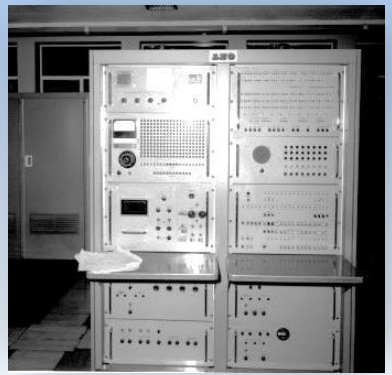
(without shooting yourself in the foot)
Part I

Tommy Atkins

Chief Development Officer (CDO)

TEMBO Technology Lab (Pty) Ltd.

1969: Trainee Operator



LEO III

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IBM System 3/10

1975: RPG II Programmer

IBM System/32

System/34

System/36

System/38

Terminal 5250

AS/400

iSeries

IBM i

Etc.

Database & Application - Design & Development

The best thing about me...
I'm a limited edition.
There are no other copies!
Bet you're thinking
thank the good lord!

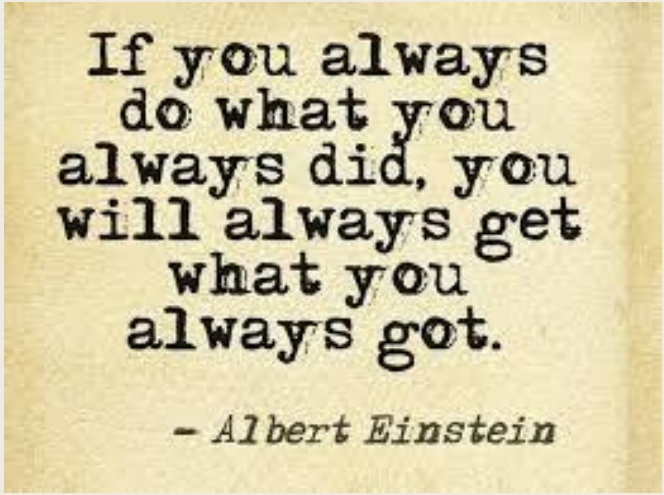
My Database

zzZZ

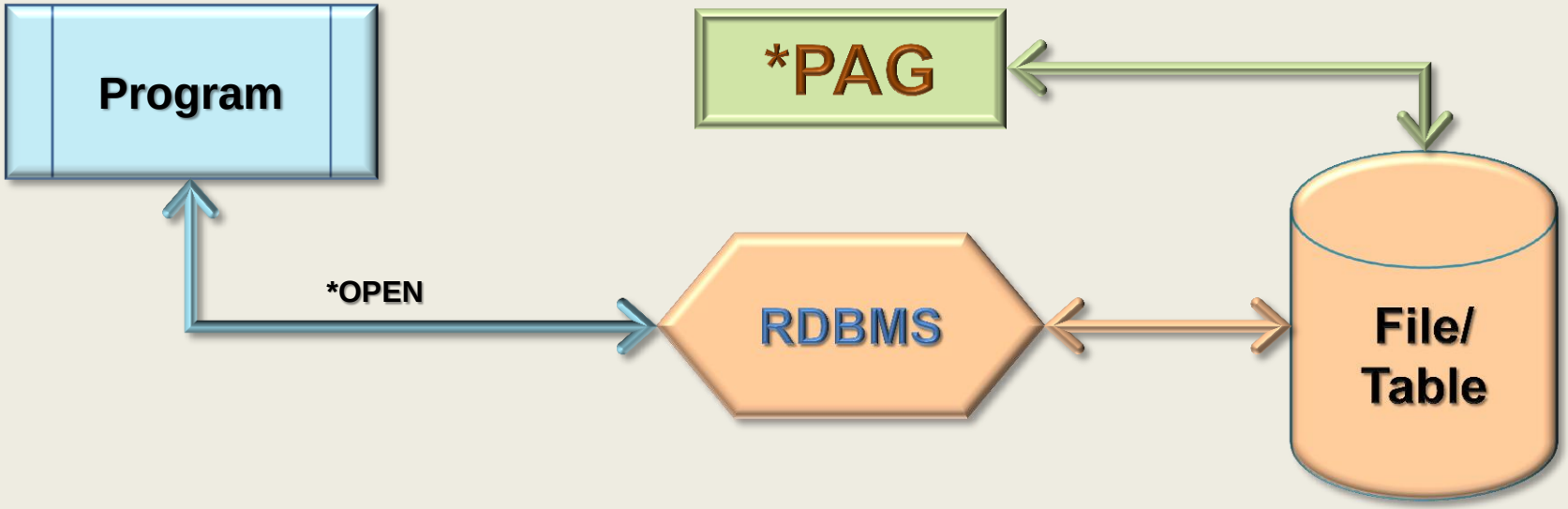
- Data Theft
- Data Corruption
- Invalid Data

Protecting the DB2 Database

- Normalization
- Constraints
  - Primary Key
  - Unique
  - Check
  - Referential
- Triggered Programs



Triggered Program Mechanics



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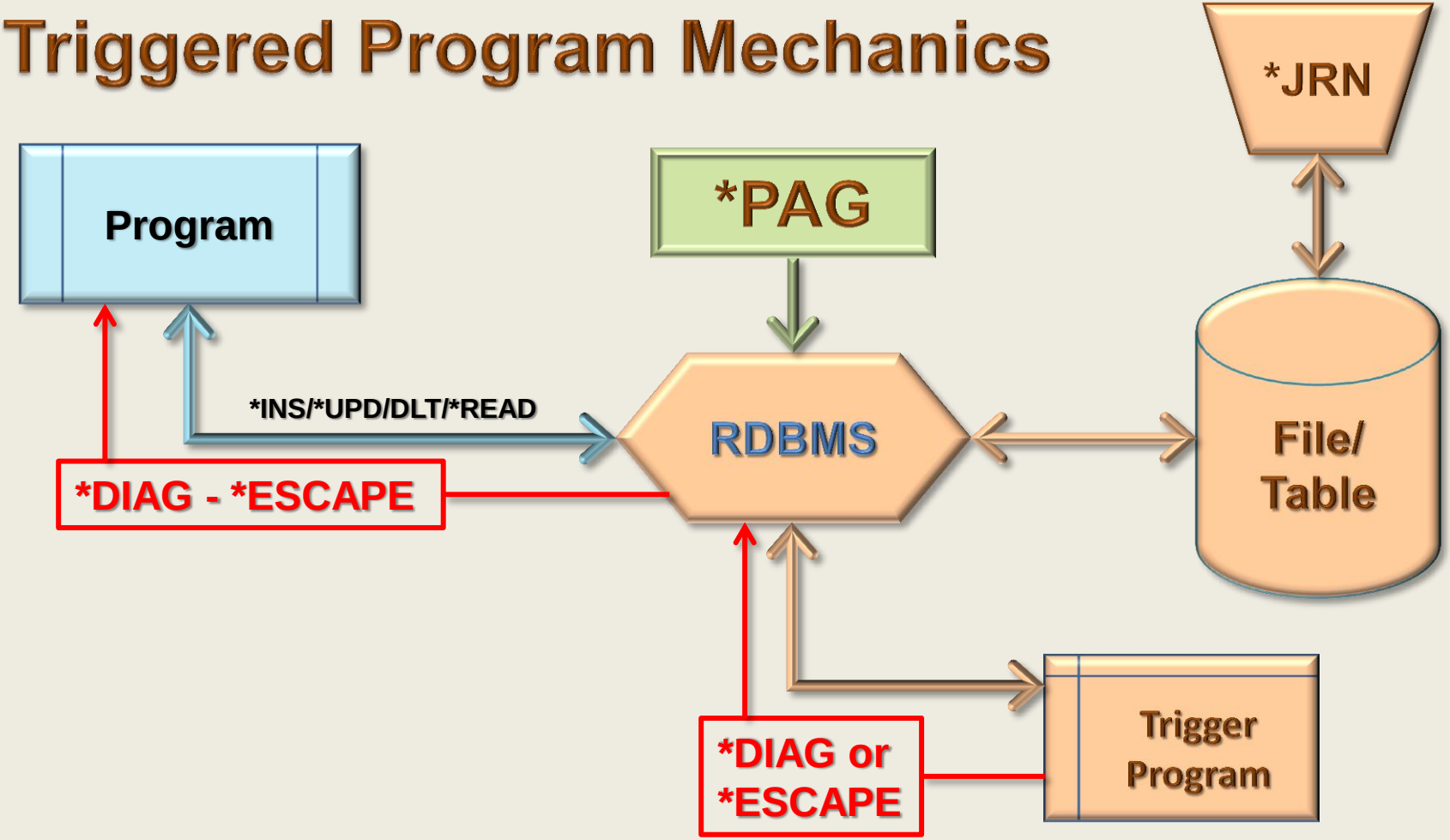
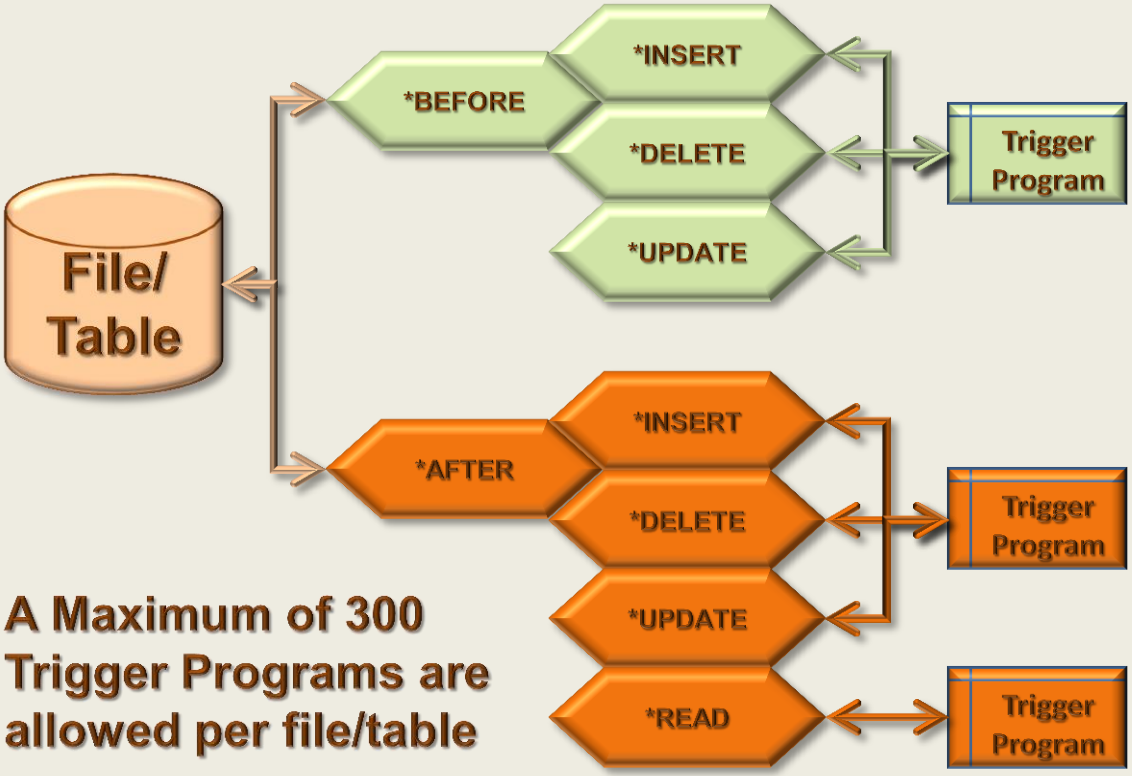


Change is hard at first,
messy in the middle,
and gorgeous at the end.
~Robin Sharma

Trigger Events

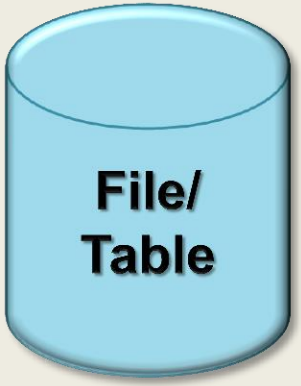


- Data Validation
- Program Access Check
- Default Provision
- Relationship Checking
- Etc. Etc. Etc.

- Data Syncronization
- Summary Maintenance
- Job Submission
- Audit Data Collection
- Read Suppression
- Etc. Etc. Etc.

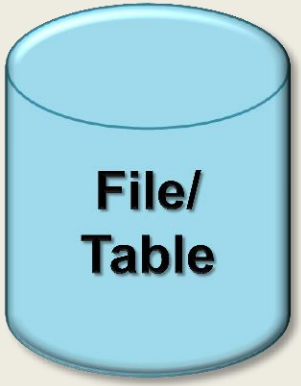
A Maximum of 300 Trigger Programs are allowed per file/table

Triggered Programs



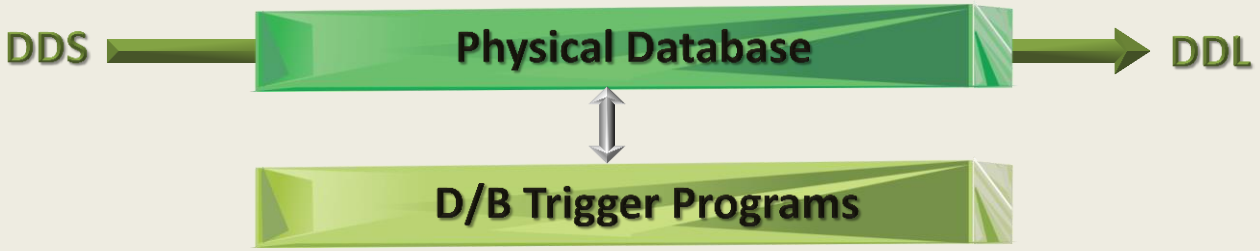

```
                    Add Physical File Trigger (ADDPFTRG)

Type choices, press Enter.

Physical file  . . . . . . . . .   _________     Name
  Library  . . . . . . . . . . .     *LIBL       Name, *LIBL, *CURLIB
Trigger time . . . . . . . . . .   ________      *BEFORE, *AFTER
Trigger event  . . . . . . . . .   ________      *INSERT, *DELETE, *UPDATE...
Program  . . . . . . . . . . . .   _________     Name
  Library  . . . . . . . . . . .     *LIBL       Name, *LIBL, *CURLIB
Replace trigger  . . . . . . . .   *NO          *NO, *YES
Trigger  . . . . . . . . . . . .   *GEN

Trigger library  . . . . . . . .   *FILE        Name, *FILE, *CURLIB
Allow Repeated Change  . . . . .   *NO          *NO, *YES
                                                                  More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys

A    A                  MW                                          05/037
```

Triggered Programs



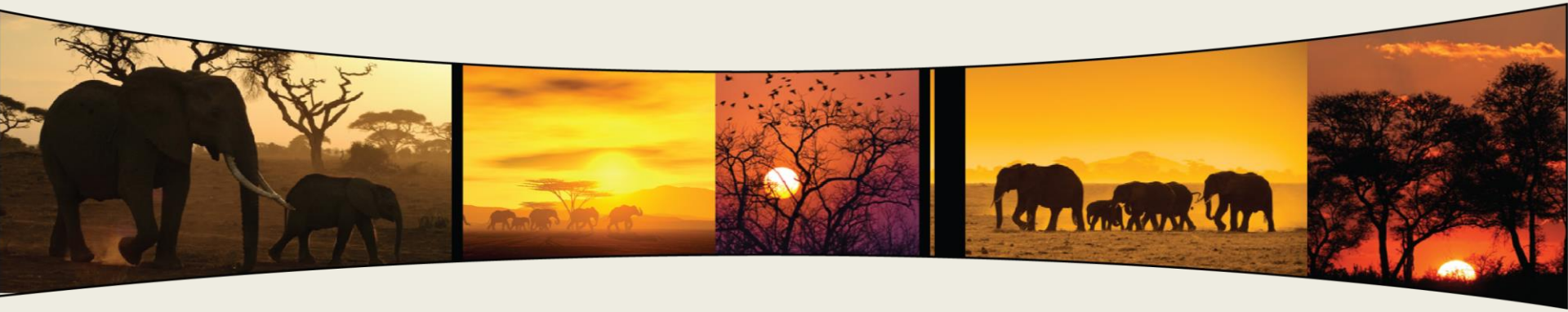

```
                    Add Physical File Trigger (ADDPFTRG)

 Type choices, press Enter.

 Threadsafe . . . . . . . . . . . .   *UNKNOWN      *UNKNOWN, *NO, *YES
 Multithreaded job action . . . .   *SYSVAL       *SYSVAL, *MSG, *NORUN, *RUN
 Trigger update condition . . . .   *ALWAYS       *ALWAYS, *CHANGE

                                                                        Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
 Messages pending on other displays.
MA    A                  MW                                          05/037
```

DB2 Modernization



Thank You

© Ursula Cedlers - Wildlife Photogra



Pulling the Trigger

(without shooting yourself in the foot)
Part II

Tommy Atkins

Chief Development Officer (CDO)

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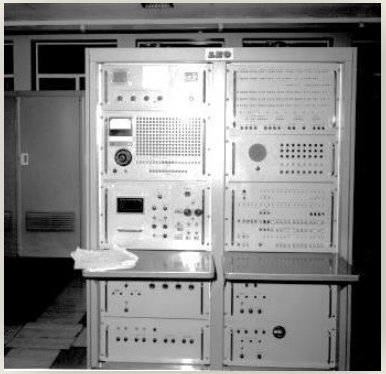
1969: Trainee Operator



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IBM System/32

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System/38

Terminal 5250

AS/400

iSeries

IBM i

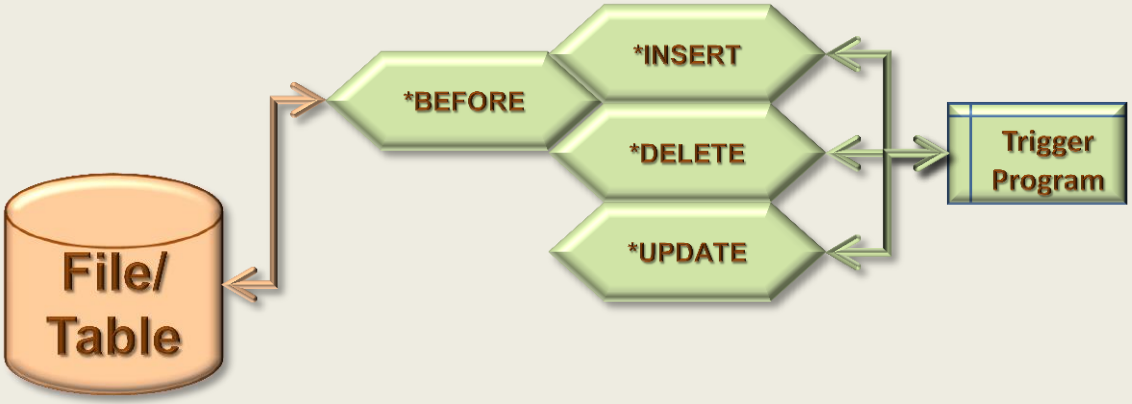
Etc.

Database & Application - Design & Development

VIA 9GAG.COM

Before you start anything, learn how to finish it.

*BEFORE Triggers



- Data Validation
- Program Access Check
- Default Provision
- Relationship Checking
- Etc. Etc. Etc.

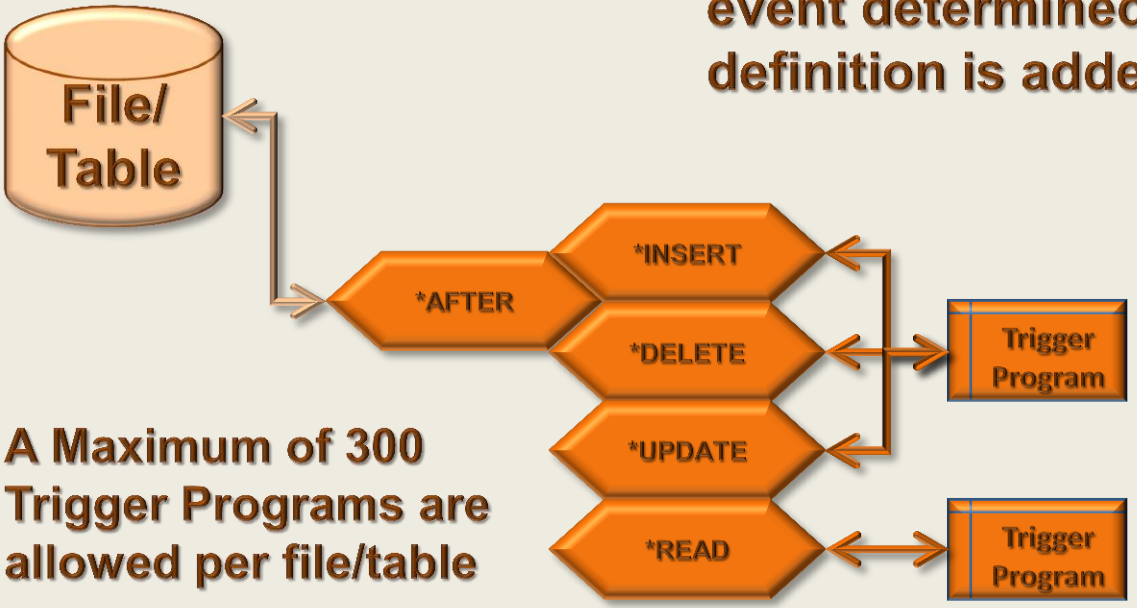
A Maximum of 300 Trigger Programs are allowed per file/table

Order of Execution: Ordinal number of event determined when trigger definition is added to the file

Switch to RDi

*AFTER Triggers

Order of Execution: Ordinal number of event determined when trigger definition is added to the file



A Maximum of 300 Trigger Programs are allowed per file/table

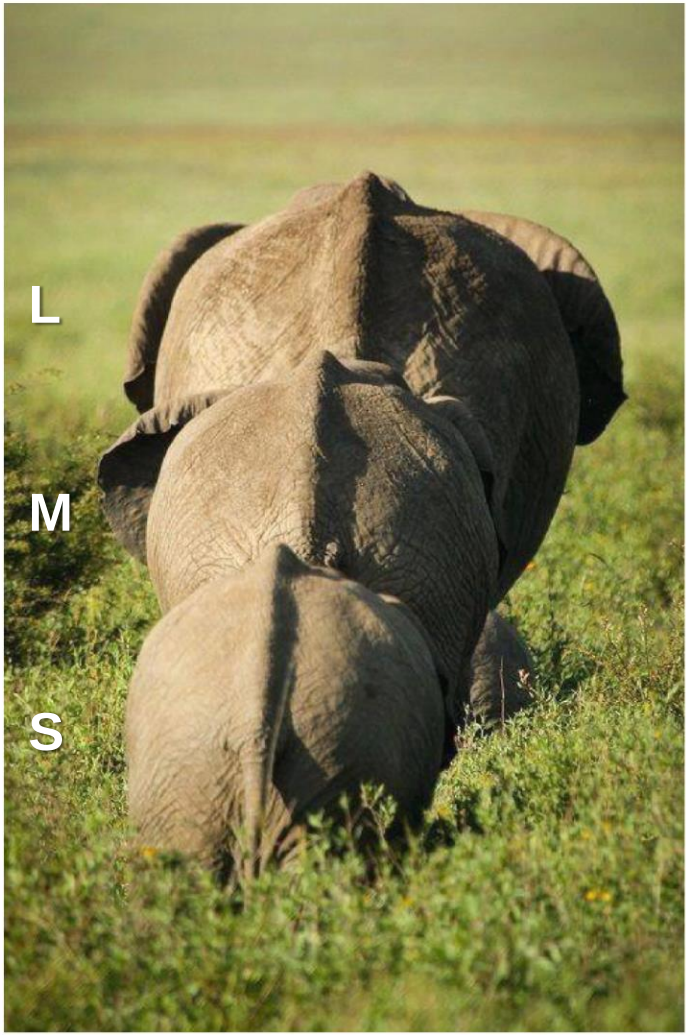
- Data Syncronization
- Summary Maintenance
- Job Submission
- Audit Data Collection
- Read Suppression
- Etc. Etc. Etc.

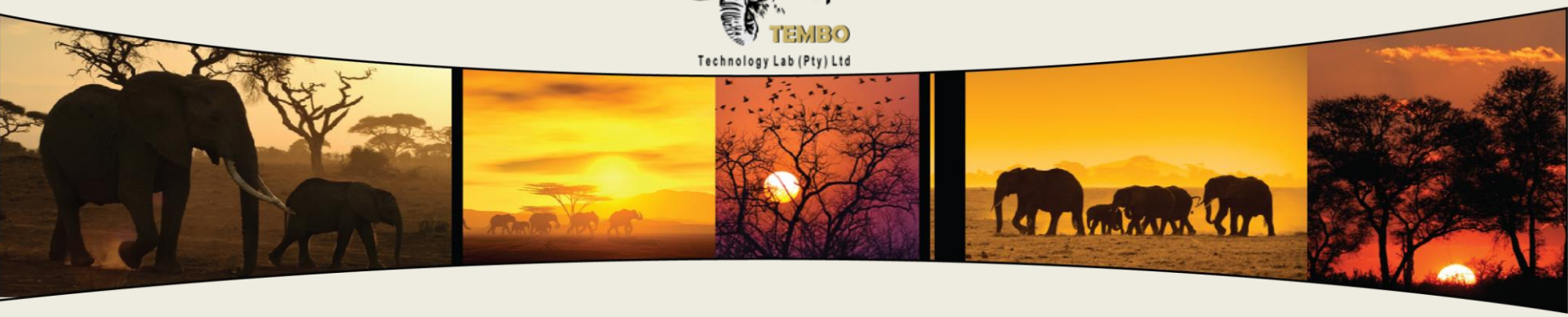
Switch to RDi

YOU MEAN TO TELL ME
HAMMERS DON'T FIX EVERYTHING

Thank You

www.ile-rpg.org/open-source.html


L
M
S



Error Percolation

Part I

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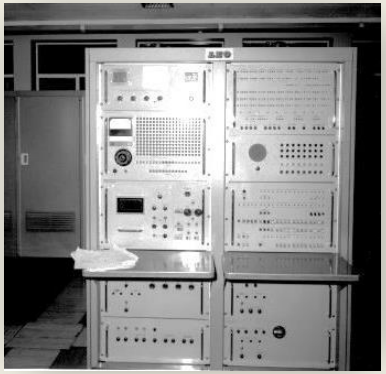

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Terminal 5250

AS/400

iSeries

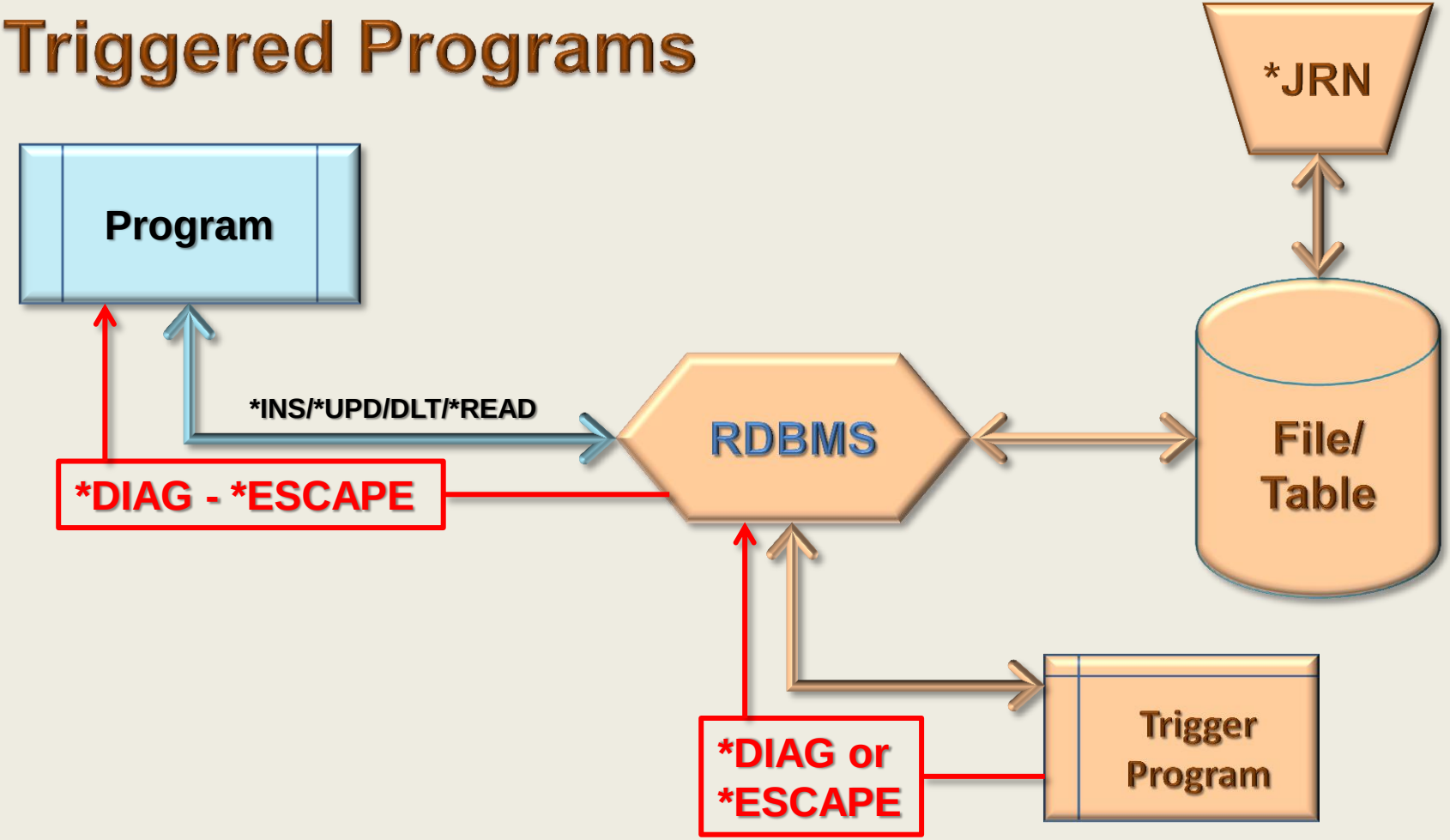
IBM i

Etc.

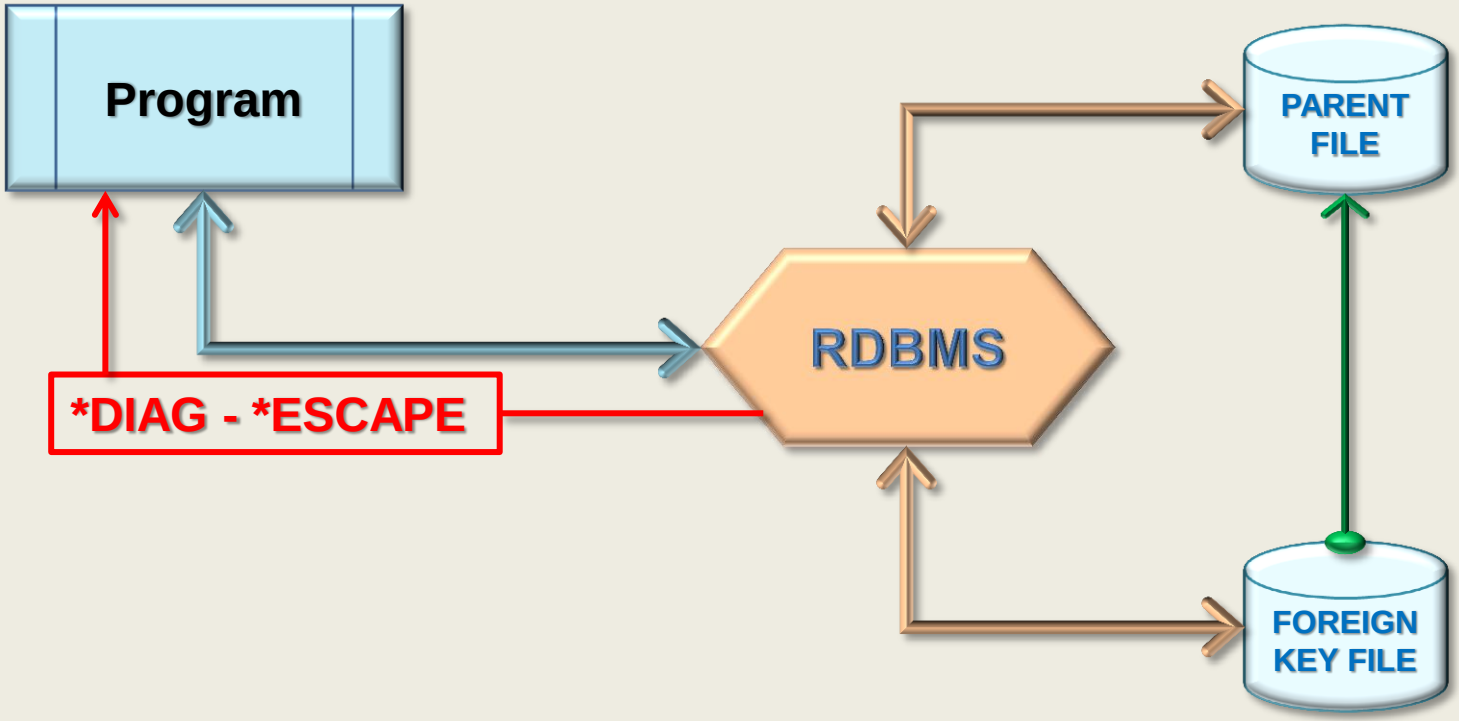
Database & Application - Design & Development

SOFTWARE
DEVELOPMENT
PROCESS
0. I can't fix this
1. Crisis of confidence
2. Questions career
3. Questions life
4. Oh it was a typo, cool
VIA 9GAG.COM

Triggered Programs



Referential Constraints



Activation Groups

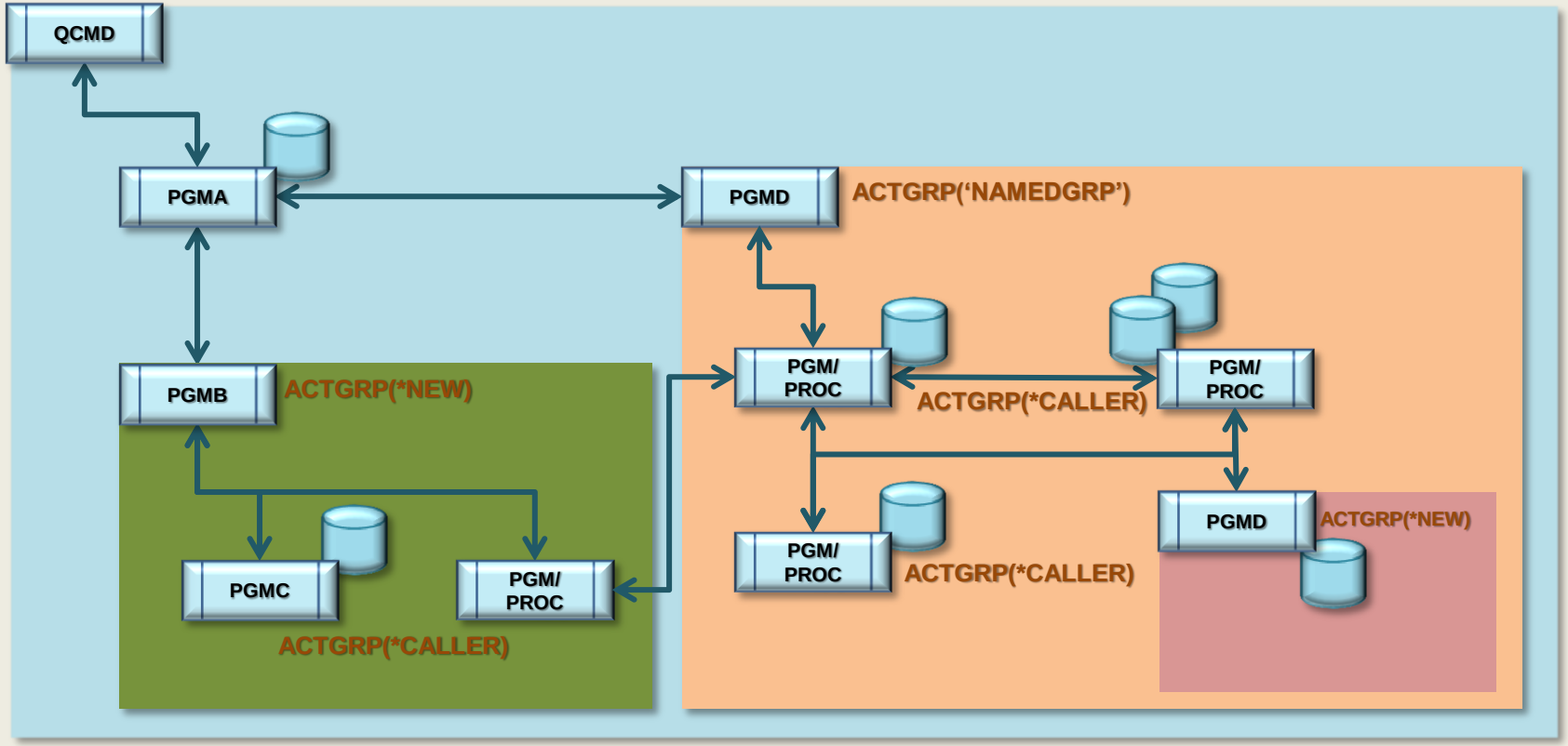
***DFTACTGRP**

QCMD

- **When a job is started on the IBMi, a *DFTACTGRP (DAG) is created, and it cannot be terminated except by ending the job. The DAG is where all original OPM program objects run as well as all OS functions.**
- **In addition, limited-function RPG IV programs can run in *DFTACTGRP. Limited function is defined as programs that don't contain any procedures, don't call any procedures, and use no contemporary built-in functions (BIFs) as well as any features that require procedures not supported by *DFTACTGRP.**

Activation Groups

***DFTACTGRP (DAG)**



Call Stack

Type	Program		Statement		Procedure
. . . .					
	UIMSRV@@	TAG_GPL_P	164		DSPPO
	QUIDSPP	QSYS		/00E4	
	QUIMGFLW	QSYS		/048F	
	QUICMD	QSYS		/0AEE	
Control Boundary	AOFM000_G	AOF_P			_QRNP_PEP_AOFM000_G
	AOFM000_G	AOF_P	87		AOFM000_G
Control Boundary	DBWB_D	AOF_P			_QRNP_PEP_DBWB_D
	DBWB_D	AOF_P	135		DBWB_D
	UIMSRV@@	TAG_GPL_P	188		DSPPN_CSR
	QUIDSPP	QSYS		/00E4	
	QUIMGFLW	QSYS		/048F	
	QUICMD	QSYS		/0AEE	
Control Boundary	DBWB_G	AOF_T			_QRNP_PEP_DBWB_G
	DBWB_G	AOF_T	260		DBWB_G
	DBWB_G	AOF_T	310		LISTENTRY
	WBMNU01_D	AOF_T			_QRNP_PEP_WBMNU01_D
	WBMNU01_D	AOF_T	83		WBMNU01_D
	UIMSRV@@	TAG_GPL_P	164		DSPPO
	QUIDSPP	QSYS		/00E4	
	QUIMGFLW	QSYS		/048F	
	QUICMD	QSYS		/0AEE	
. . . .					

Call Stack

. . . .

Control Boundary	WBMNU01_G	AOF_T			_QRNP_PEP_WBMNU01_G
	WBMNU01_G	AOF_T	145		WBMNU01_G
	WBM001_D	AOF_T			_QRNP_PEP_WBM001_D
	WBM001_D	AOF_T	128		WBM001_D
	UIMSRV@@	TAG_GPL_P	140		DSPPN
	QUIDSPP	QSYS		/00E4	
	QUIMGFLW	QSYS		/048F	
	QUICMD	QSYS		/0AEE	
Control Boundary	WBM001_G	AOF_T			_QRNP_PEP_WBM001_G
	WBM001_G	AOF_T	206		WBM001_G
	WBM170_D	AOF_T			_QRNP_PEP_WBM170_D
	WBM170_D	AOF_T	171		WBM170_D
	UIMSRV@@	TAG_GPL_P	188		DSPPN_CSR
	QUIDSPP	QSYS		/00E4	
	QUIMGFLW	QSYS		/048F	
	QUICMD	QSYS		/0AEE	
Control Boundary	WBM170_G0	AOF_P			_QRNP_PEP_WBM170_G0
	WBM170_G0	AOF_P	1000001		WBM170_G0
	QTEVSIRF	QSYS		/0232	

TRAP
and
HANDLE
All Errors

DONT
HATE
Perco-
late

Percolation

*DIAG x n
*ESCAPE

```
WBMNU01_G   AOF_T                                  _QRNP_PEP_WBMNU01_G
WBMNU01_G   AOF_T          145                     WBMNU01_G
WBM001_D    AOF_T                                  _QRNP_PEP_WBM001_D
WBM001_D    AOF_T          128                     WBM001_D
UIMSRV@@    TAG_GPL_P      140                     DSPPN
QUIDSPP     QSYS                       /00E4
QUIMGFLW    QSYS                       /048F
QUICMD      QSYS                       /0AEE
WBM001_G    AOF_T                                  _QRNP_PEP_WBM001_G
WBM001_G    AOF_T          206                     WBM001_G
WBM170_D    AOF_T                                  _QRNP_PEP_WBM170_D
WBM170_D    AOF_T          171                     WBM170_D
UIMSRV@@    TAG_GPL_P      188                     DSPPN_CSR
QUIDSPP     QSYS                       /00E4
QUIMGFLW    QSYS                       /048F
QUICMD      QSYS                       /0AEE
WBM170_G0   AOF_P                                  _QRNP_PEP_WBM170_G0
WBM170_G0   AOF_P          1000001                 WBM170_G0
```

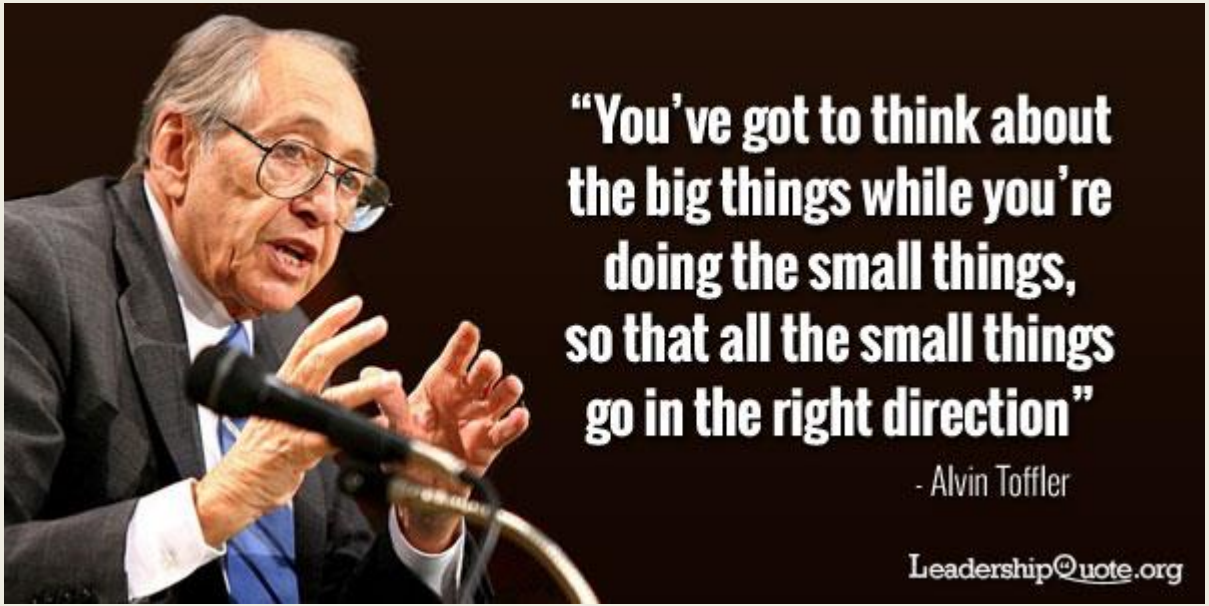
Percolation

- System Message API's
- Pre-Defined Messages
- Call Stack API's
- Other

Modernization =

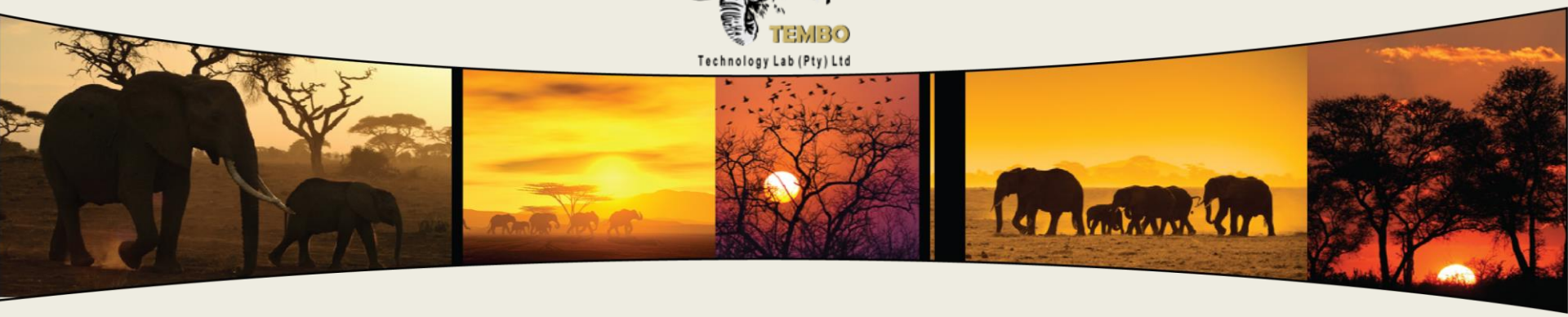
Simplification
Consolidation
Centralization
Standardization

Programming;
Art or Science ?



Thank You

© Pete Bette
Photography



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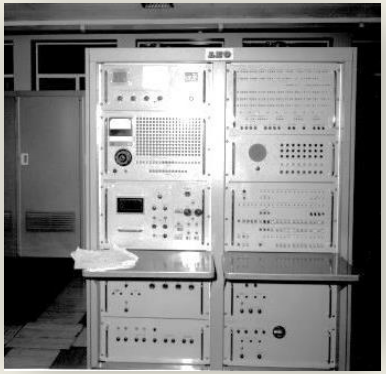

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Code Once!

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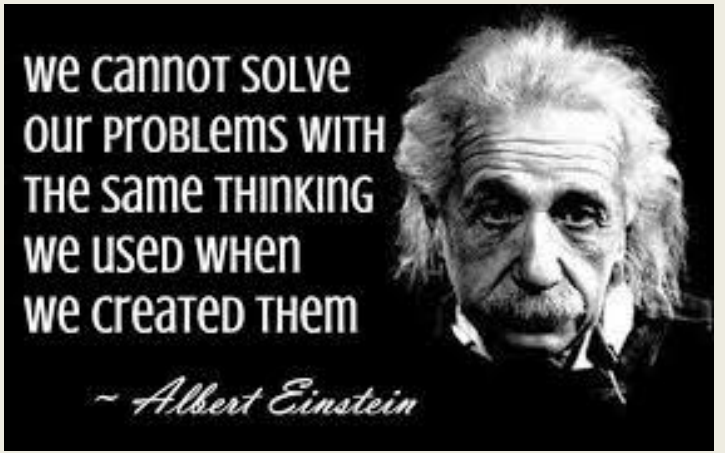
~Robin Sharma

Old Keys
Won't Open
New Doors


We cannot solve
our problems with
the same thinking
we used when
we created them
~ Albert Einstein

Modernization =

Simplification
Consolidation
Centralization
Standardization

Switch to RDi

Thank You

www.ile-rpg.org/open-source.html

African Pygmy Kingfisher

Copyright Don Cowie

Secretary Bird

Kudu Bull

© Pete Bette
Photography

Mashtulele

Andre Liebenberg Photography

JUST HANGIN' AROUND

© Ursula Celliers - Wildlife Photography