Highly efficient Auto batch EFA

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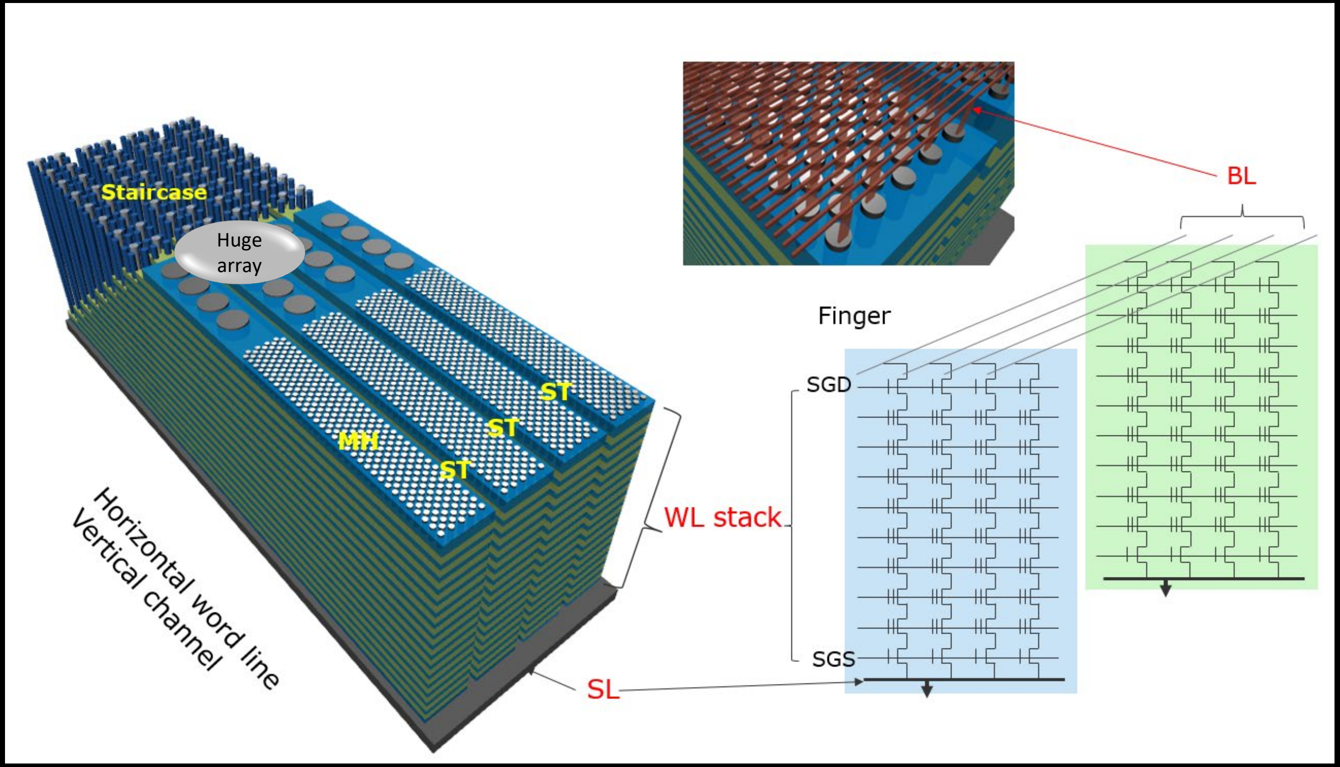
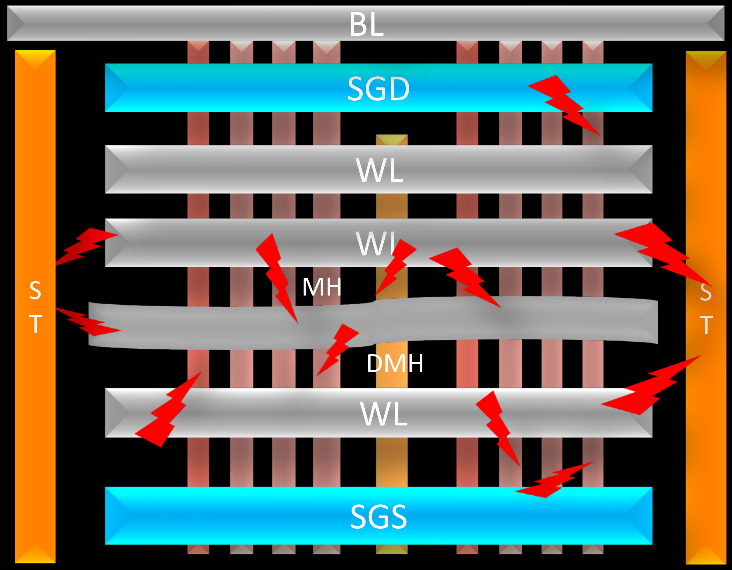
Defect in Nand Array

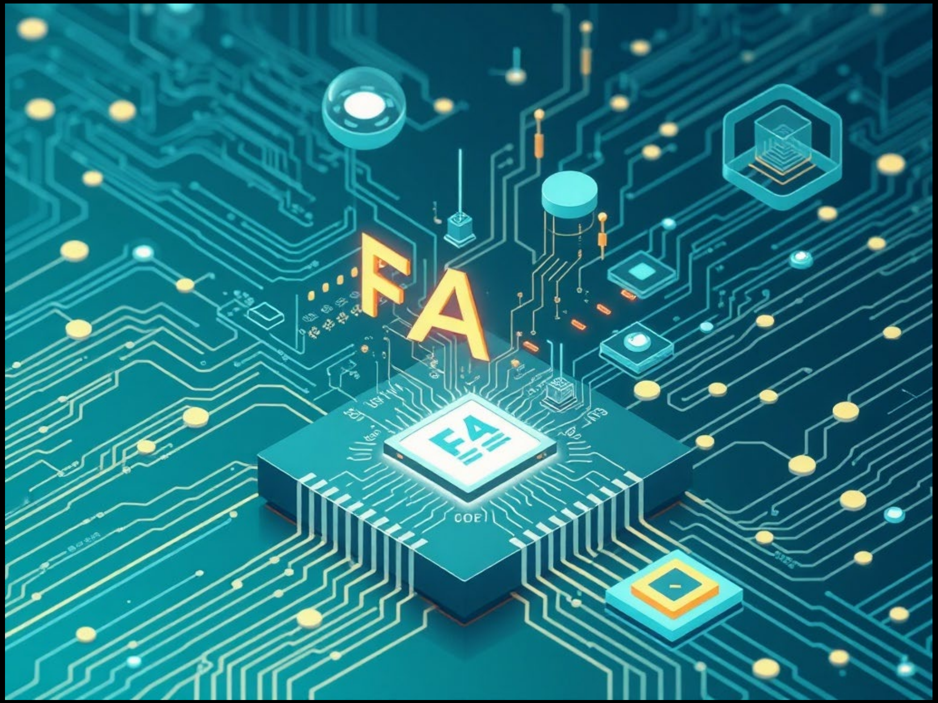
The NAND array occupies a large portion of the circuit area, resulting in most failures occurring within the array.

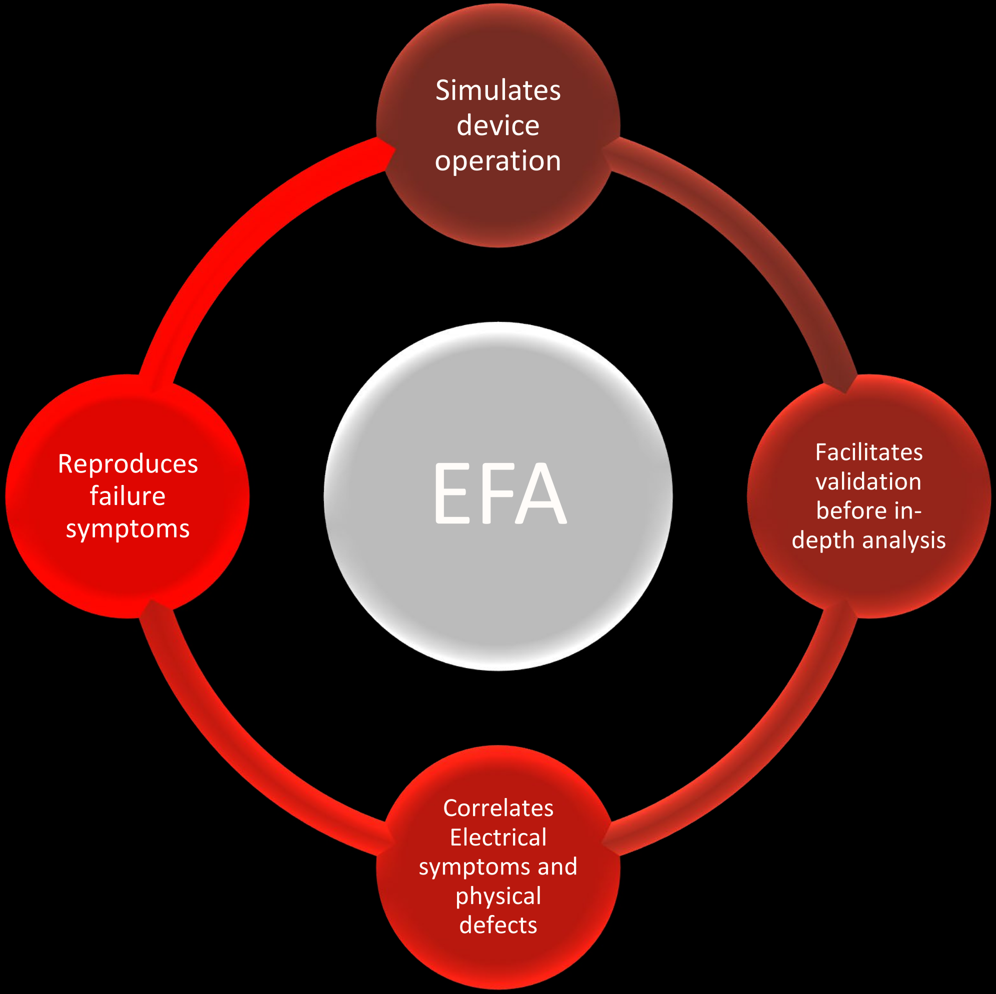




EFA(Electronical Failure Analysis) in Nand world

- **Purpose**: Identify and characterize electrical failures in semiconductor devices or electronic components.
- **Goal**: Pinpoint the root cause of failure to improve yield, reliability, and design robustness.





EFA

Simulates device operation

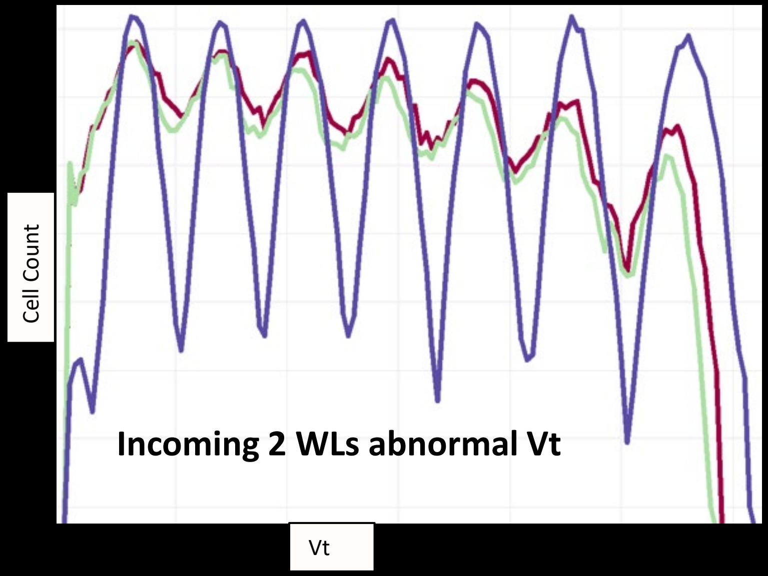
Facilitates validation before in-depth analysis

Correlates Electrical symptoms and physical defects

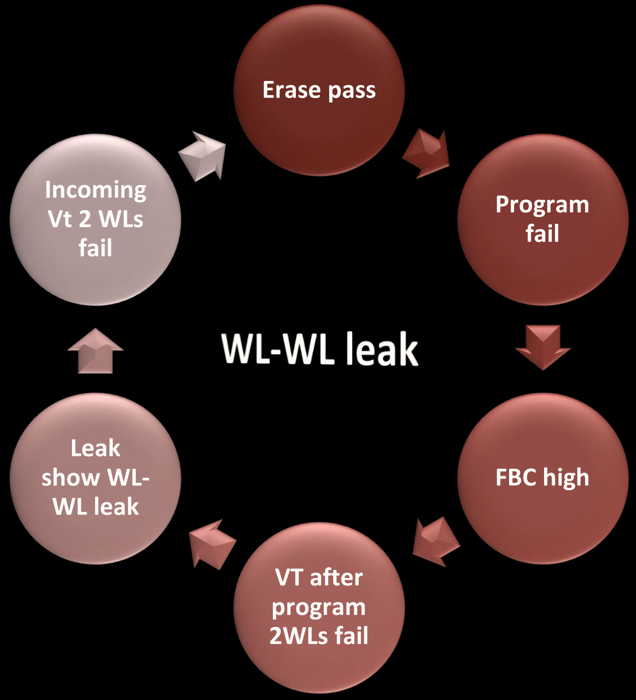
Reproduces failure symptoms

Data collection for Nand EFA

Incoming Vt → Erase Program status → FBC after reprogram → Vt after reprogram → Detail cell Vt → Leak Detection

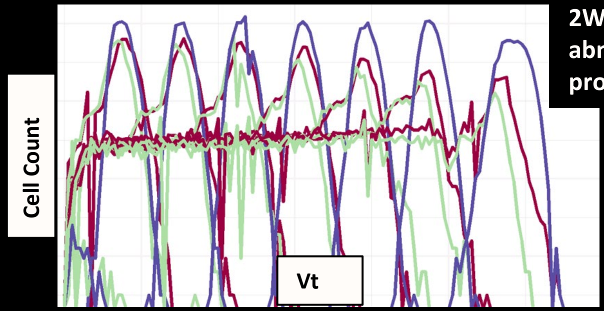


Incoming 2 WLs abnormal Vt

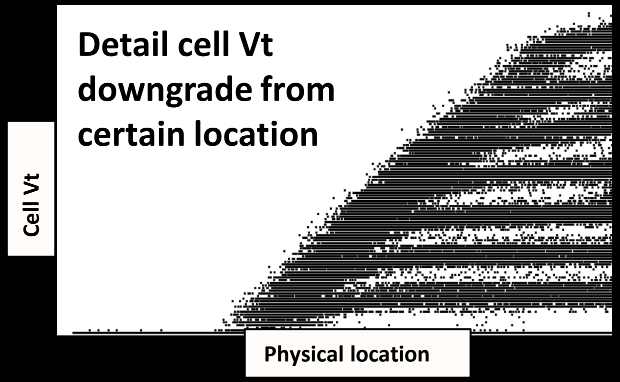


WL-WL leak

Erase pass → Program fail → FBC high → VT after program 2WLs fail → Leak show WL-WL leak → Incoming Vt 2 WLs fail → Erase pass



2WLs Vt abnormal after program fail



Detail cell Vt downgrade from certain location

"START" "REPEAT" "1988/2025"

EFA strength(200 failure for example)

Yesterday **Today** **Tomorrow**

Load unit

Manually collect all failure information

Manually plot and create PPT

Repeatedly analyze the data

Unload unit

Repeat 200+ times, 2 Engineers 25days. Extra 7 days for failure judge.

Automatically collect data within 0.5 day

Automatically generate failure report

Semi-Auto judge the failure mode

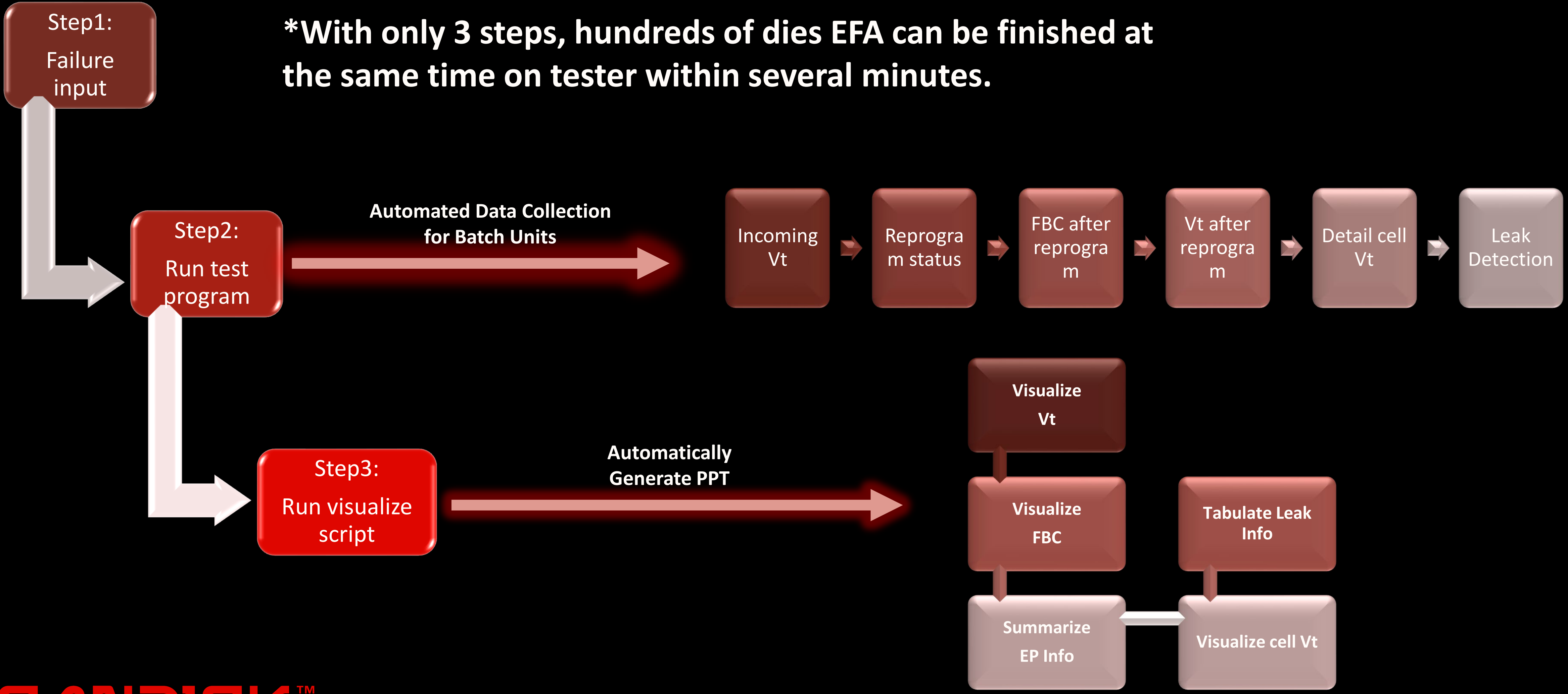
One time, 1 Engineer 0.5 day. Extra 3 days for failure judge.

No engineer need, automatically feedback to fab and device

On the fly failure information feedback to process and device to further improve

EFA for today-Highly efficient Auto batch EFA

***With only 3 steps, hundreds of dies EFA can be finished at the same time on tester within several minutes.**



Step1: Failure input

Step2: Run test program

Automated Data Collection for Batch Units

Incoming Vt → Reprogram status → FBC after reprogram → Vt after reprogram → Detail cell Vt → Leak Detection

Step3: Run visualize script

Automatically Generate PPT

Visualize Vt

Visualize FBC

Summarize EP Info

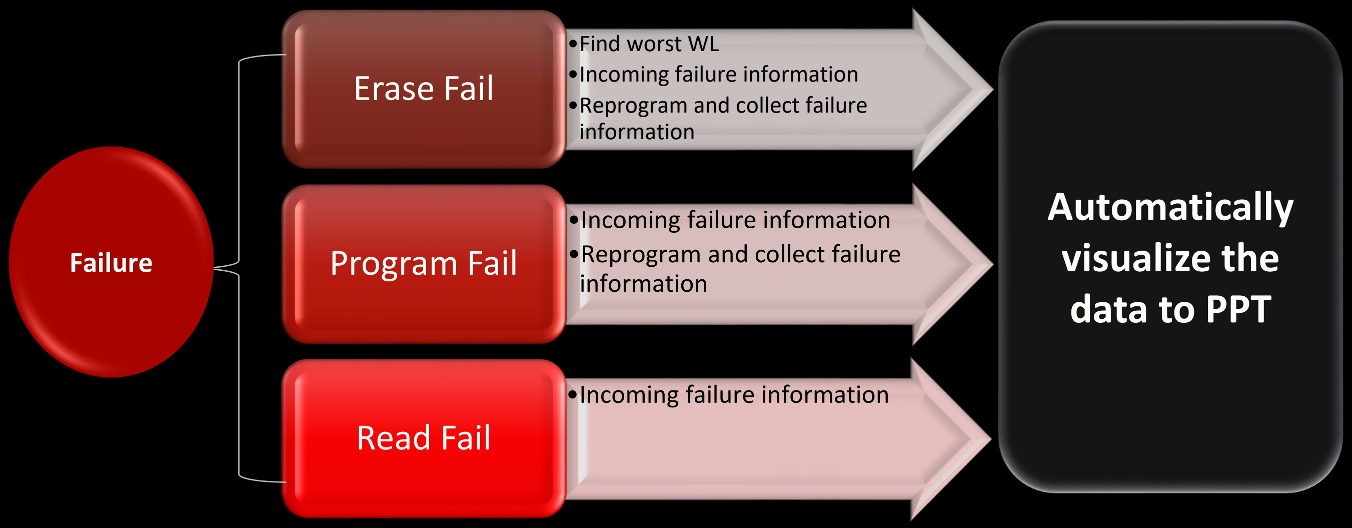
Visualize cell Vt

Tabulate Leak Info

EFA for today-Respective EFA flows

Failure input

Die_ID	Failure Type	Cycle	Block	WordLine	String
X1_Y1_Z1	Erase fail	C1	M1	N1	P1
X2_Y2_Z2	Program fail	C2	M2	N2	P2
X3_Y3_Z3	Read fail	C3	M3	N3	P3
X4_Y4_Z4	Erase fail	C4	M4	N4	P4
X1_Y1_Z1	Program fail	C5	M5	N5	P5
X2_Y2_Z2	Read fail	C6	M6	N6	P6



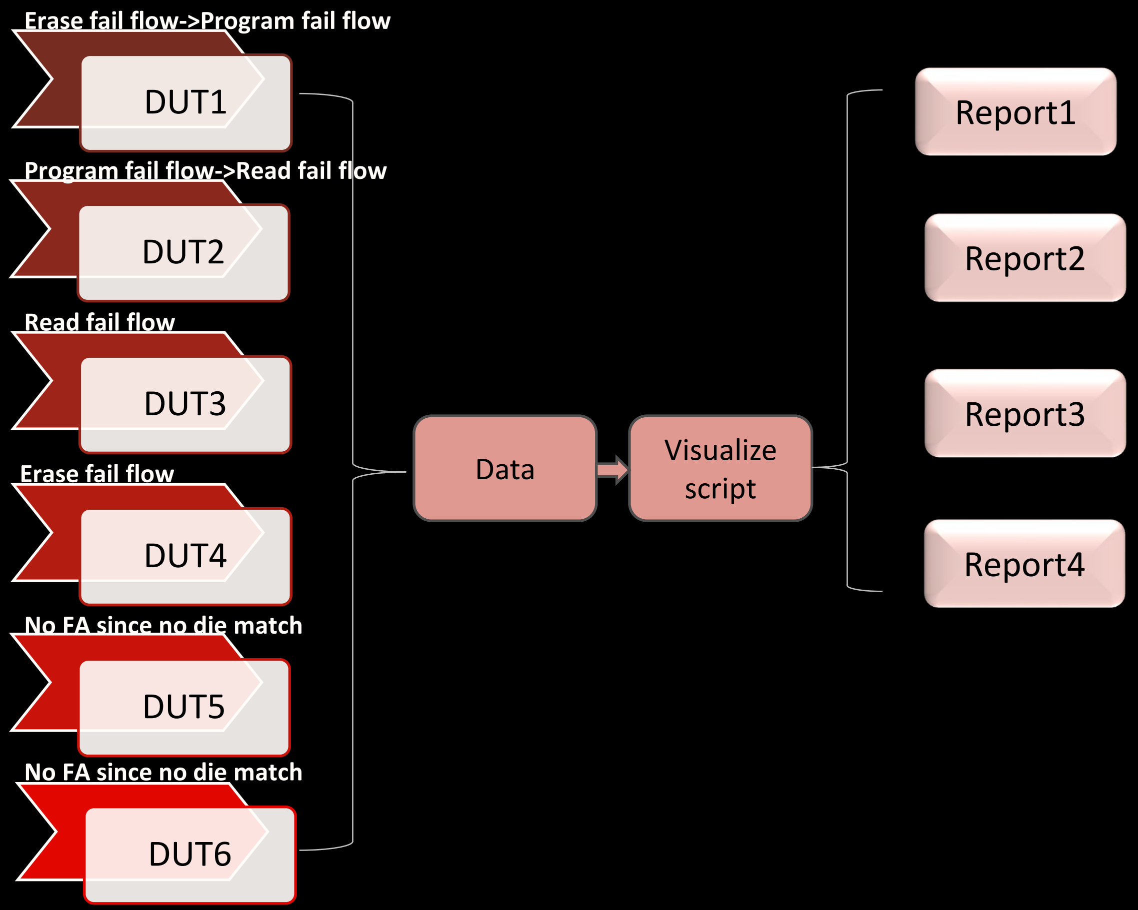
Failure

Erase Fail
- Find worst WL
- Incoming failure information
- Reprogram and collect failure information

Program Fail
- Incoming failure information
- Reprogram and collect failure information

Read Fail
- Incoming failure information

Automatically visualize the data to PPT



Erase fail flow->Program fail flow

DUT1

Program fail flow->Read fail flow

DUT2

Read fail flow

DUT3

Erase fail flow

DUT4

No FA since no die match

DUT5

No FA since no die match

DUT6

Data

Visualize script

Report1

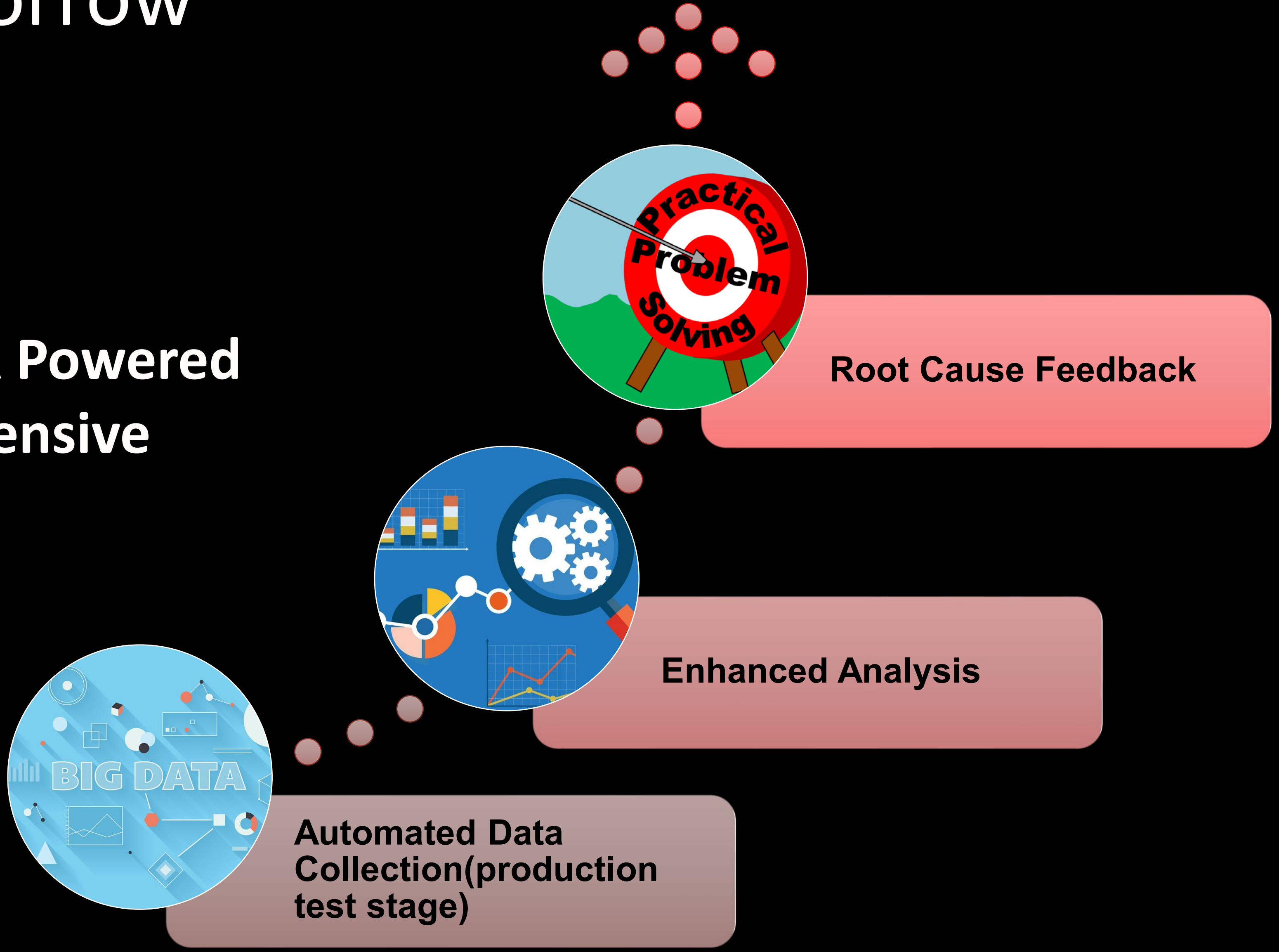
Report2

Report3

Report4

EFA for tomorrow

Intelligent EFA Powered by AI with Extensive Data Base

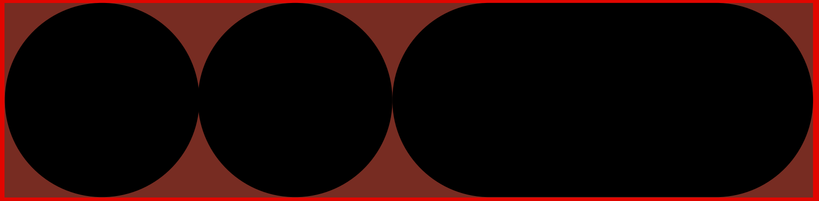


Root Cause Feedback

Enhanced Analysis

Automated Data Collection(production test stage)

“START” “REPEAT” “1988/2025”



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