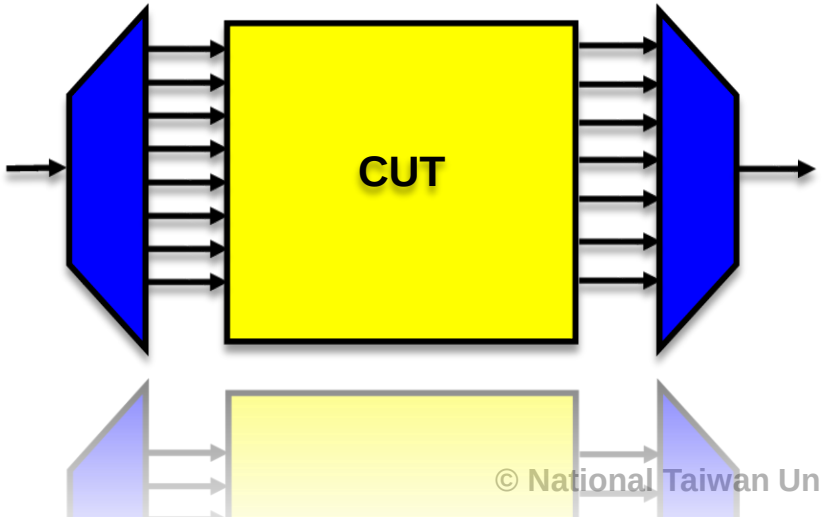
Test Compression

- Introduction
- Test Stimulus Compression
- Test Response Compression
- Industry Practices * (not in exam)
  - OPMISR+ [Cadence, IBM]
  - Embedded Deterministic Test, EDT [Mentor Graphics]
  - VirtualScan and UltraScan [Syntest]
  - DFT Max and Adaptive Scan [Synopsys]
- Conclusion



Categories

- Linear-decompression-based schemes
  - Two steps: ATPG followed by compactor design
    - ETCompression, LogicVision
    - EDT, Mentor Graphics
    - SOCBIST, Synopsys

  + ATPG unchanged

  - patterns can increase

  - fault coverage drop
- Broadcast-scan-based schemes
  - Single step: ATPG together with compactor design
    - OPMISR+, Cadence
    - VirtualScan and UltraScan, SynTest
    - DFT MAX and Adaptive Scan, Synopsys

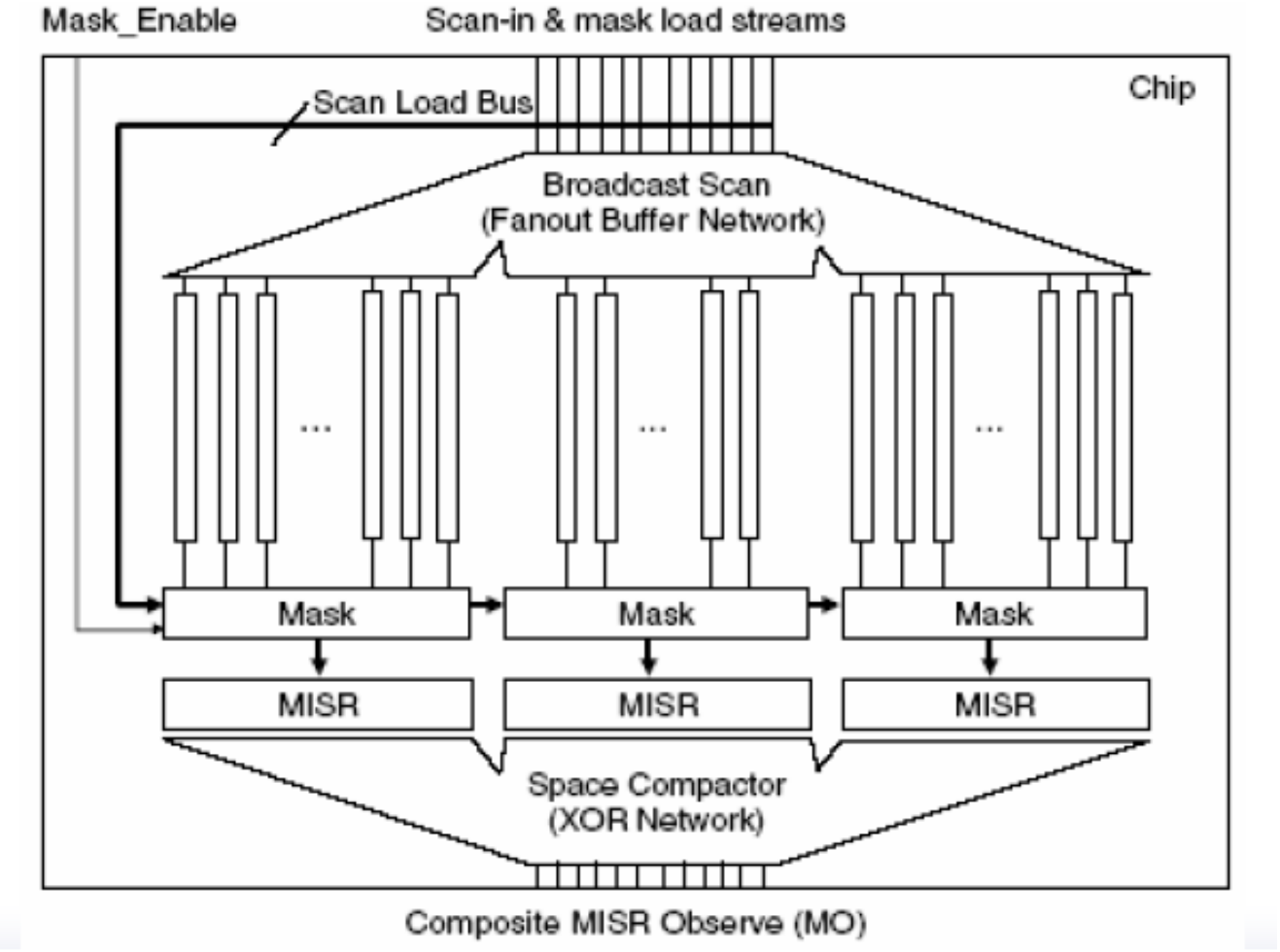
  + few patterns

  + accurate coverage

  - slow ATPG

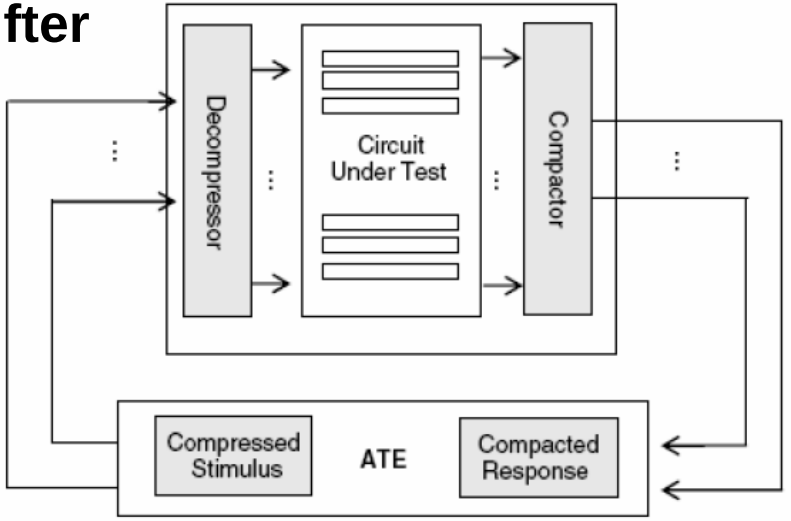
OPMISR+

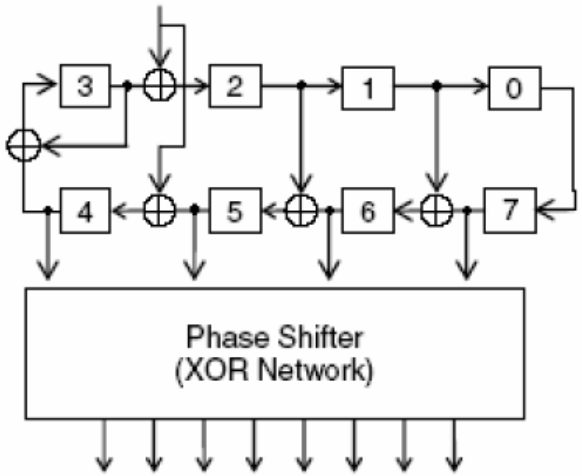
- **Input : broadcast using fanout buffer network**
- **Output: XOR network**

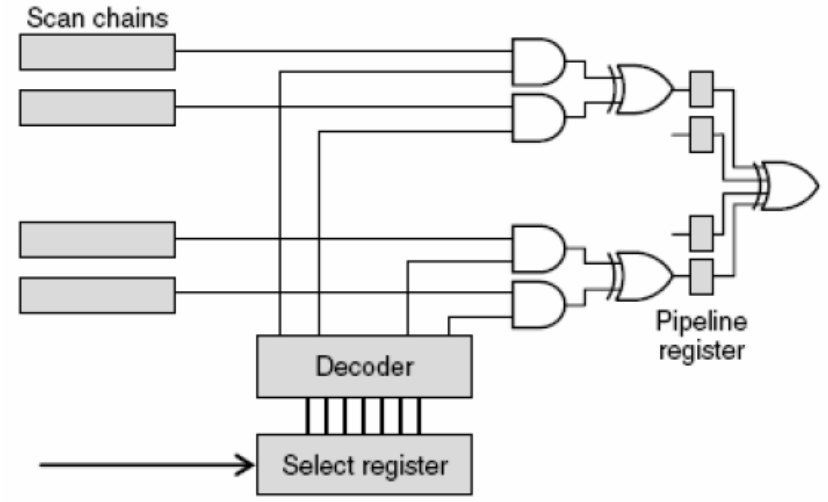


EDT [Rajski 04]

- Input: ring generator + phase shifter
  - Faster than LFSR
- Output:
  - X masking and XOR

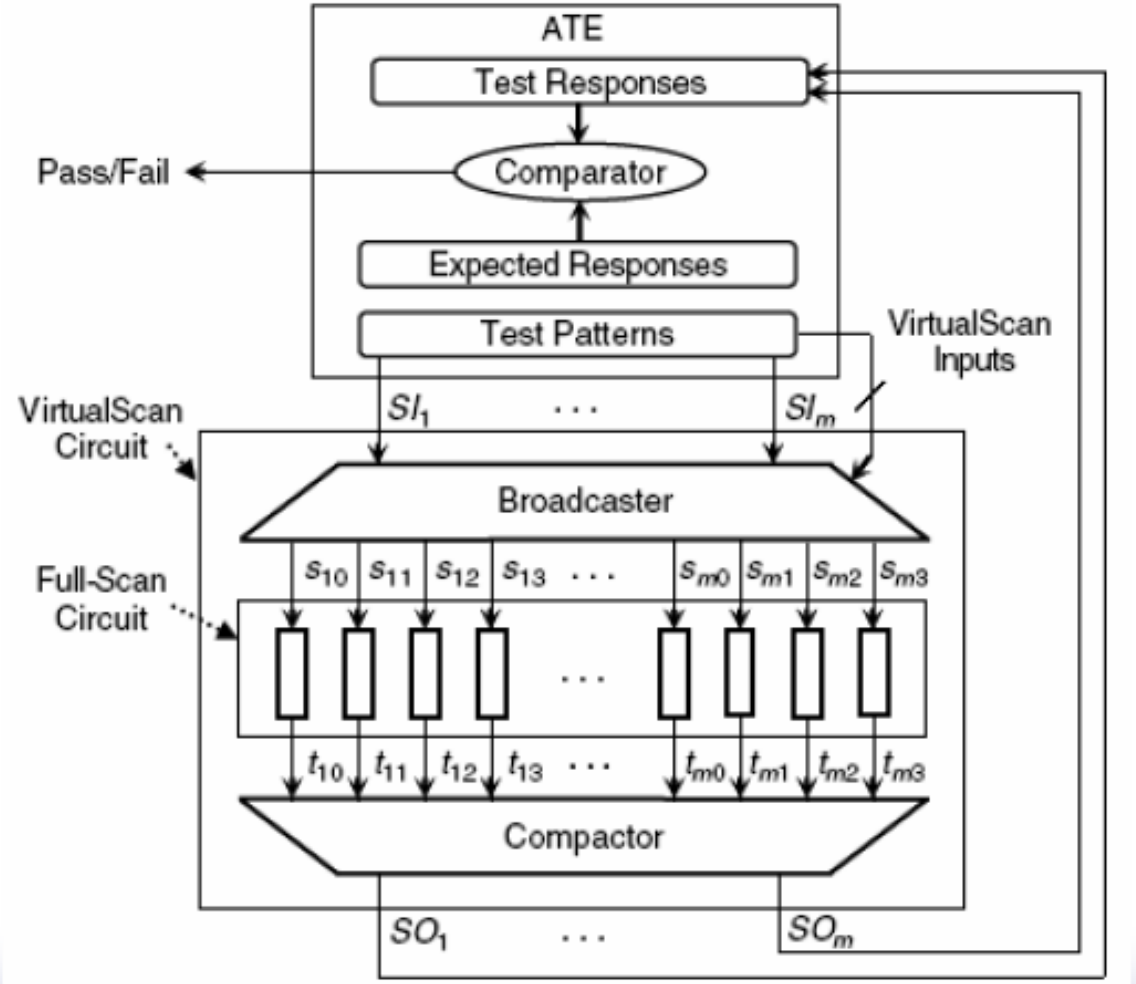






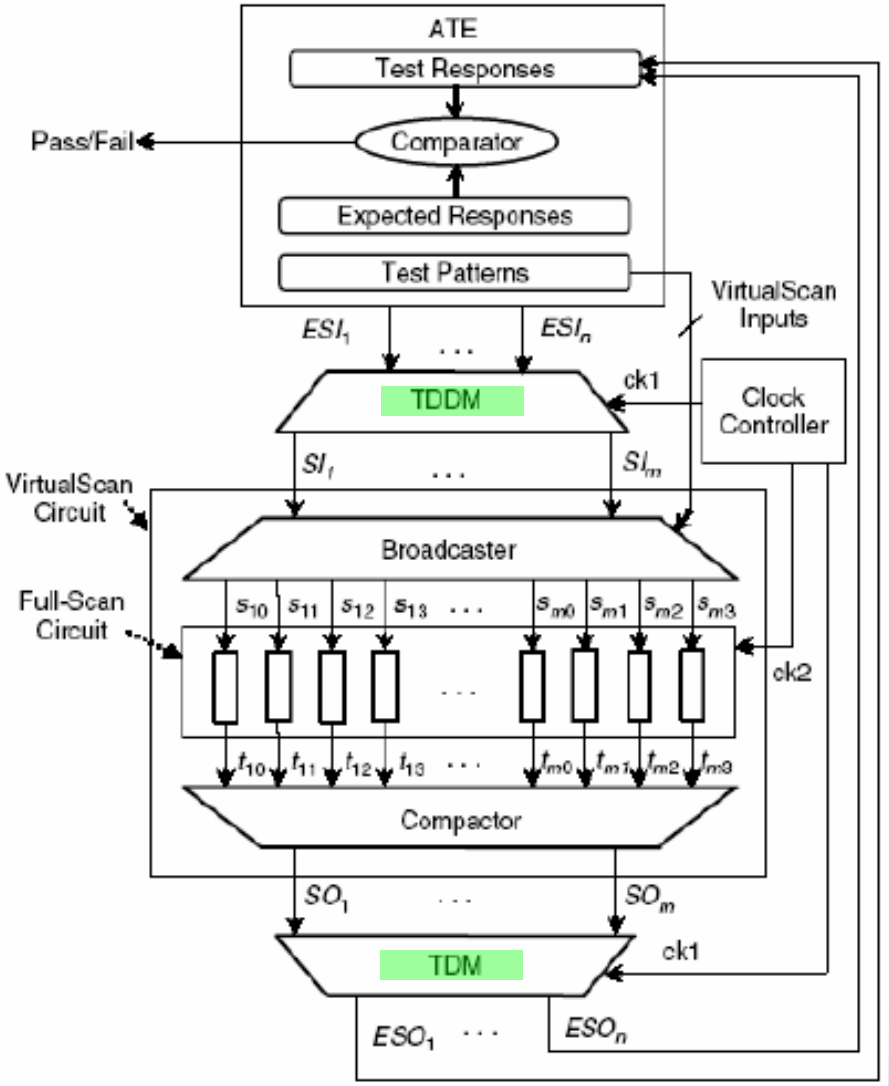
VirtualScan

- **Input: broadcast using combinational logic**
  - **AND OR NAND NOR MUX XOR ...**
- **Output: X-impact**



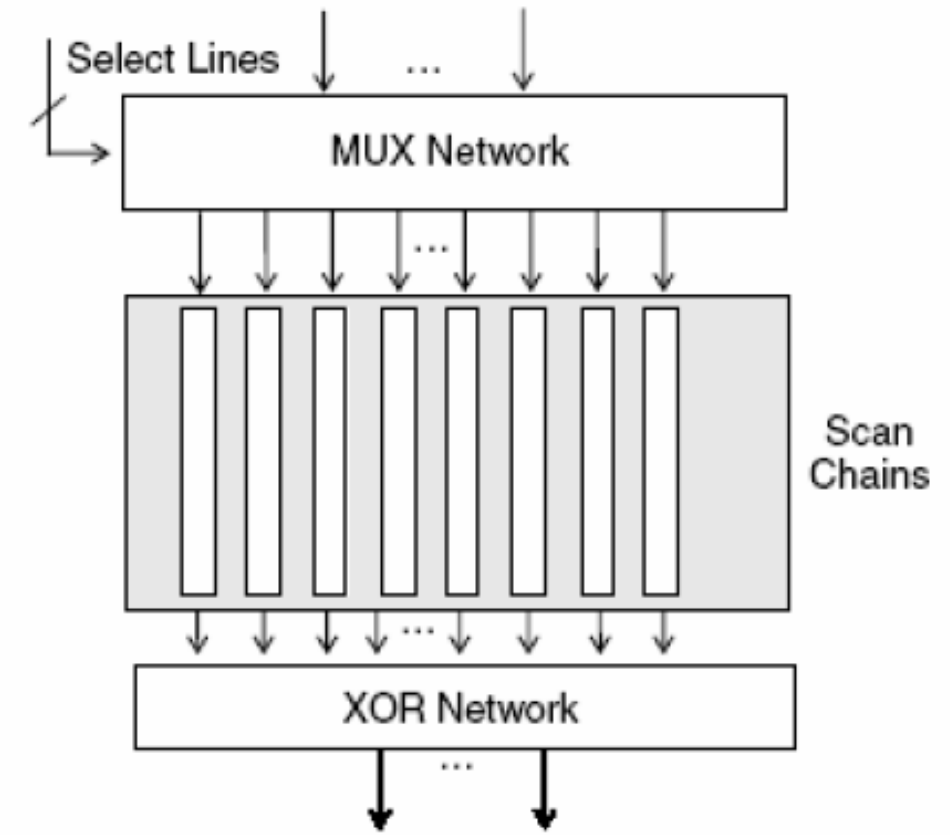
UltraScan

- based on the fact that I/O Pad are faster than scan chains
- Input: Time division demultiplexer, TDDM
- Output: Time division multiplexer, TDM



Adaptive Scan

- **Input: broadcast using MUX**
- **Output: XOR network (like X-compact)**



Summary

Industry Practice	Stimulus Decompressor	Response Compactor
OPMISR+	Broadcast scan (Illinois scan)	MISR with XOR network
TestKompress	Ring generator	XOR network
VirtualScan	Combinational logic network	XOR network
DFT MAX	Combinational MUX network	XOR network
ETCompression	(Reseeding) PRPG	MISR
UltraScan	TDDM	TDM

MISR: multiple-input signature register

MUX: multiplexers

PRPG: pseudo-random pattern generator

TDDM: time-division demultiplexer

TDM: time-division multiplexers

XOR: exclusive-OR

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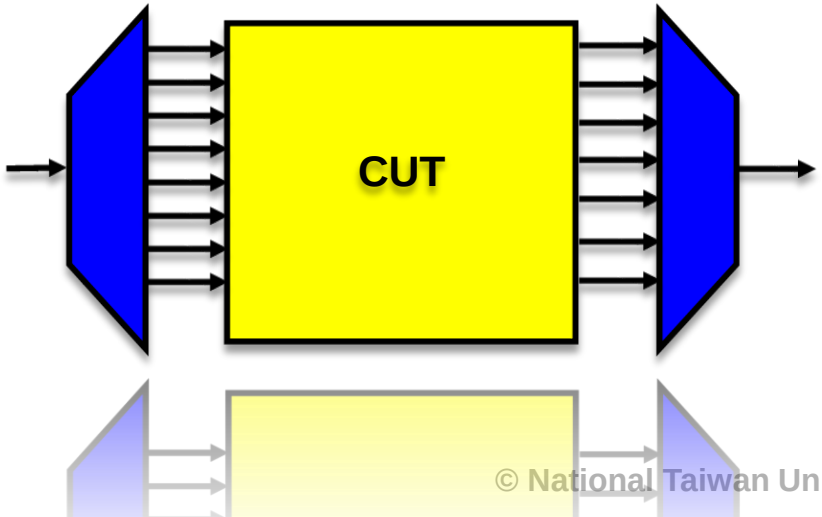

Concluding Remark

- Test compression now becomes a necessary step in DFT and ATPG

- How to select a suitable compression technique?
  - Trade-off between
    - Compression ratio
    - Fault coverage degradation
    - X-tolerant
    - Design efforts (CFI, CFS)
    - ATPG run time

References

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