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OCP VIP: cost effective and robust qualification process

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Introduction

- OCP characteristics offers:
 - Flexibility and configurability: every hardware IP can have an optimum interface.
 - Scalability: interfaces can be easily changed.
 - Simplified core implementation, integration and timing analysis
 - Immediate benefit for bandwidth.
- Some OCP numbers:
 - two mandatory signals and more than fifty optional signals that can be independently selected.
 - 15-40 configuration parameters depending on signals => behavioral parameters.

State-of-Art Verification IP

- Must satisfy the following general requirements:
 - Covers most of/all protocol aspects.
 - Validated with a proven flow and methodology.
 - Usable for multiple abstraction layers.
 - Measures functional coverage.
 - Checks interface compliance with protocol rules.
 - Provides a re-usable reference model.
 - Keeps environment up-to-date with new protocol versions.

OCP-VIP extra requirements

- Accuracy and Quality:
 - Inherits protocol flexibility and scalability.
 - Available as master, slave or monitor.
 - Validated on every possible interface/profile.
 - Optimized for simulation performances.
- OCP characteristics bring also new scenarios:
 - added values to be coupled with advanced verification techniques
 - impossibility to define an unique OCP conformance test procedure => cost effective approach required.

OCP-VIP Qualification Process

- Pre-qualification process status:
 - The number of allowed profiles (interface signals + configuration parameters) is very high.
 - Tests must run on each profile.
 - Coverage metrics defined on a large pool of items (signals binding, parameters, OCP checks, etc.).
- Qualification Process for OCP VIP is based on:
 - Semi-heuristic approach => effectiveness.
 - Long lasting experience of OCP VIP product support => completeness.

Qualification Process principles

- The methodology:
 - Extends OCP-IP consortium official checks, coverage items and standard configurations.
 - Systematically filters redundant profiles.
 - Adds or reuses tests to the regression suite to get unprecedented level of cross-coverage over profiles, configurations and OCP checks.
 - VIP profiling (code coverage and performances).
- The benefit:
 - Increases OCP VIP quality and robustness whatever profile or configuration the final users have chosen.

Qualification Process approach (1/5)

- Transfer OCP flexibility into profiles:
 - OCP-VIP interface signals.
 - OCP-VIP configuration parameters (features).
 - Rules to combine signals and features.
 - OCP checks to exercise.
- A profile can be figured out as a table master:
 - One dimension (X-axis) identifies the signals list.
 - The other (Y-axis) accommodates the features list.
 - Some cells are blackened and they represent rules.

Qualification Process approach (2/5)

OCP signals

OCP features

- A table master is a matrix able to accommodate interface signals and features.

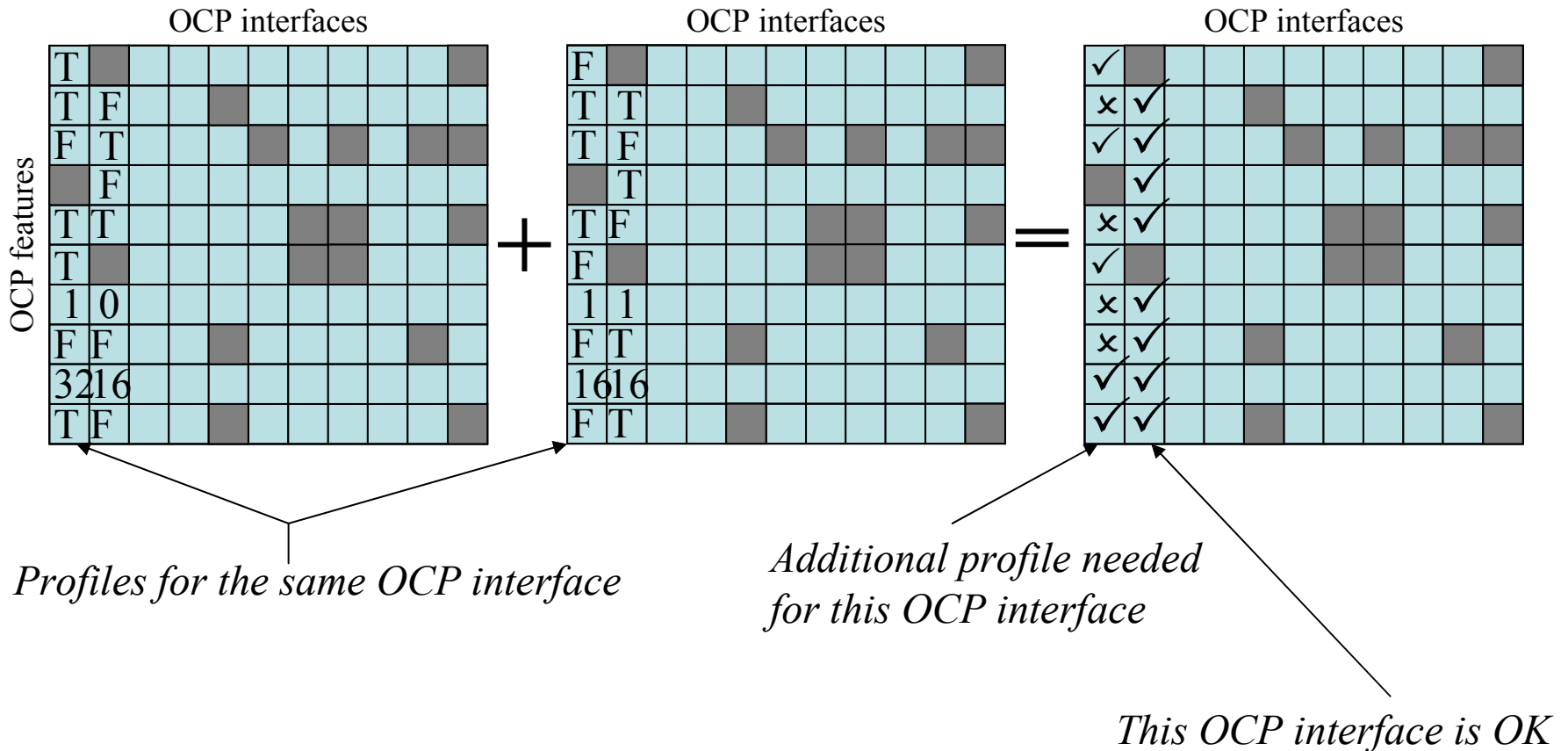
- For a selected OCP interface (column), highlights eventual forbidden combinations with parameters.

OCP interfaces

OCP features

Qualification Process approach (4/5)

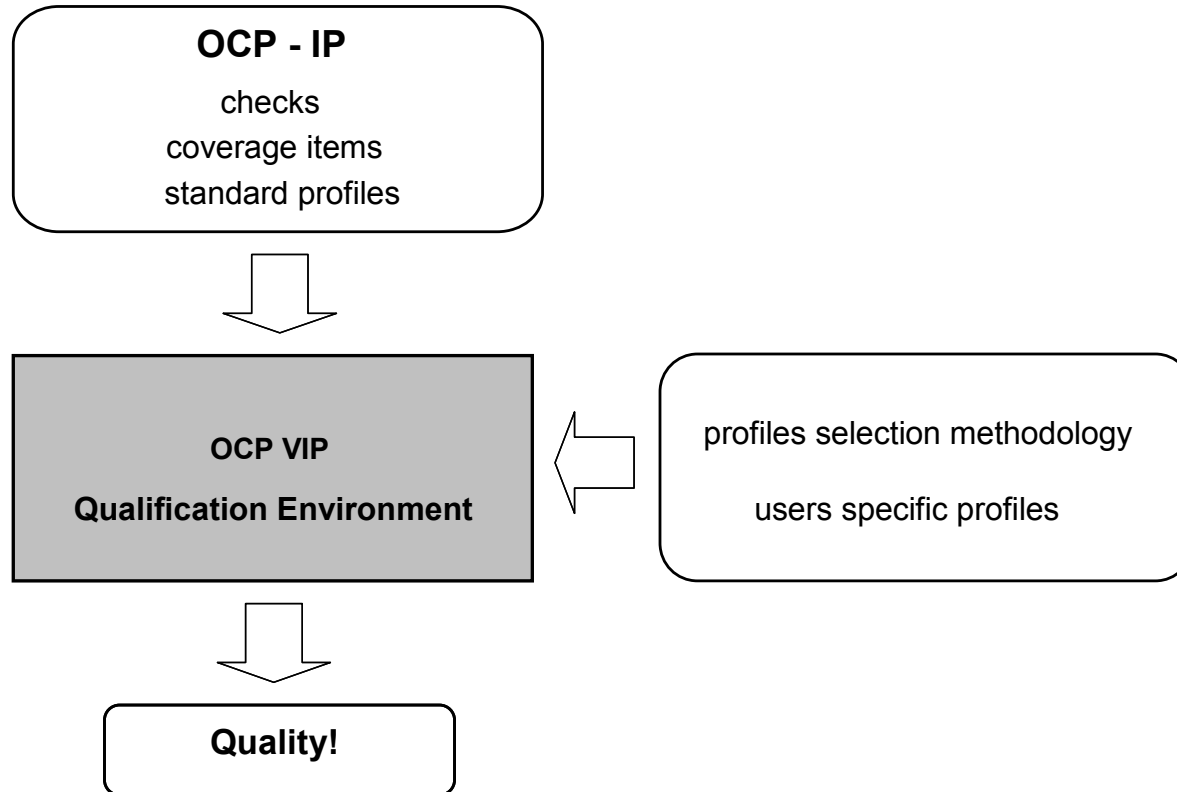
- Missing profiles will come out in comparison.



Qualification Process approach (5/5)

- Creation of random, pseudo-random and deterministic tests:
 - 100% of OCP functional coverage for each profile.
- OCP-VIP checks validation:
 - Every check needs to be represented in a VIP coverage item.
 - Reuse of the regression test suite.
 - Error injection mechanism to cause (emulate?) a protocol error.

Qualification Process flow



Qualification Process: profile numbers

- More than 50 OCP interfaces:
 - 7 from OCP-IP Specifications.
 - About 40 from on-the-field applications.
 - Few extensions of customer and OCP-IP specs interfaces.
- Around 200 OCP profiles:
 - Every OCP interface has a generic boolean parameter twice with the TRUE value and twice with the FALSE value.
 - Maximised cross coverage for parameters' values.

Qualification Process: test numbers

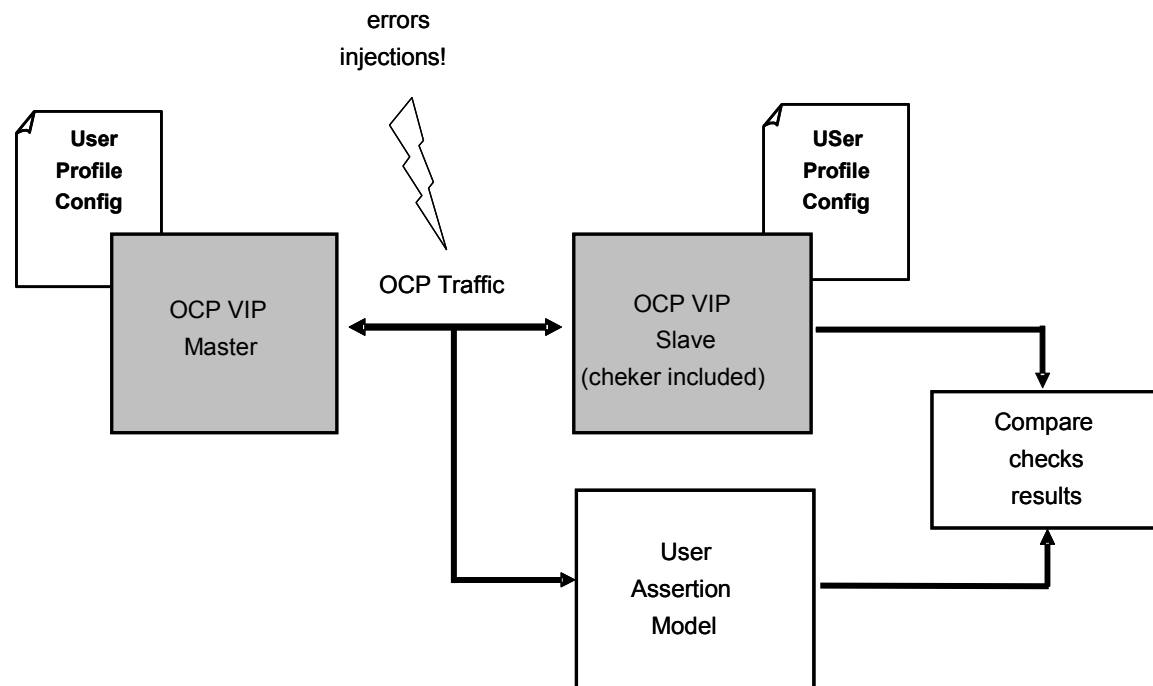
- 30 OCP-VIP tests:
 - 5 fully random.
 - 15 semi-random.
 - 10 deterministic.
- The final regression suite:
 - Every test (with some randomness) executed with 250 different seeds.
 - 200 profiles * 20 random tests * 250 seeds = 1000 thousands tests.
 - 100% of OCP, profiles and checks coverage.

Qualification Process: results

- Quality and stability in an OCP VIP bring direct and indirect benefits to the user.
- OCP VIP becomes a reliable reference model for new OCP soft models.

OCP VIP + QP as reference model (1/2)

- An assertion based model is validated and qualified against the OCP VIP reference model using a per-profile approach.



OCP VIP + QP as reference model (2/2)

- Adopted approach:
 - Rerun the portion of regression test for the profile.
 - Inject protocol errors to see only the expected error messages from the user assertion model.
 - Without protocol errors not to see any error messages from the user assertion model.
 - Errors generated from the model under qualification are compared against those resulting from the OCP-VIP reference model.

OCP VIP + QP for VIP migration (1/3)

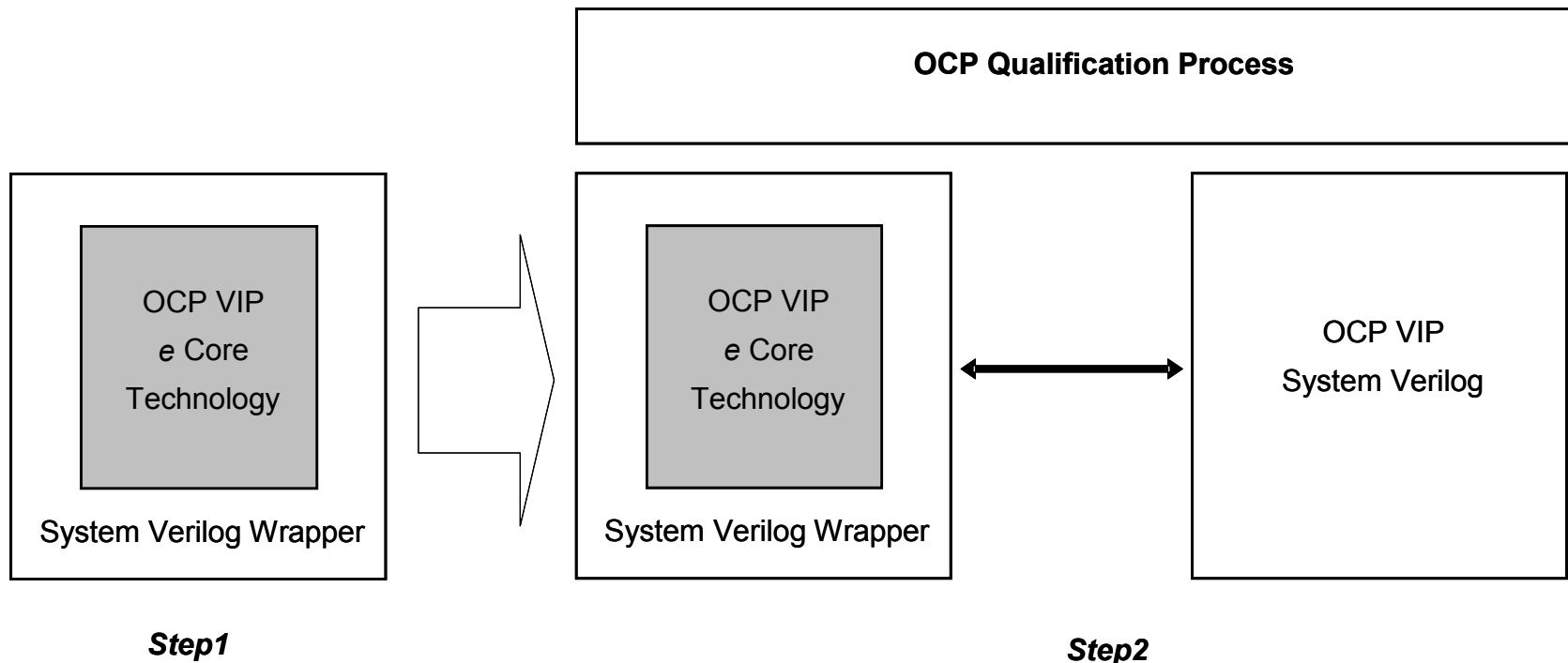
- The problem:
 - New implementation for same protocol does not automatically imply same maturity as the original one.
- The possible solution:
 - OCP VIP regression test suite is by construction complete and has a reasonable number of tests.
 - The regression test suite + the OCP VIP together can guarantee also the quality of the new VIP.

OCP VIP + QP for VIP migration (2/3)

- Step by step:
 - The original OCP VIP used as a proven and reliable model can be wrapped to be ready for use in a multi-language verification environment.
 - A new regression test suite can be created to validate the new OCP VIP implemented in a different native verification language.

OCP VIP + QP for VIP migration (3/3)

- A plus can be:
 - OCP QP “wrapping”
 - Regression based on the QP metrics





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