

INTRODUCTION

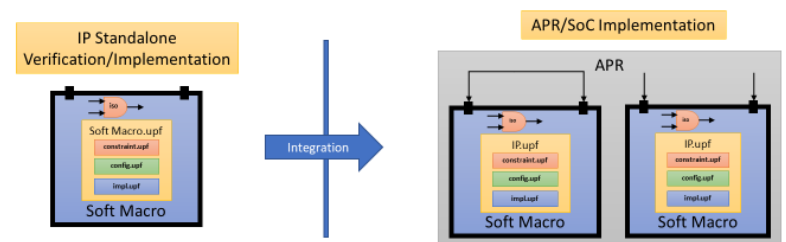
• Problem statement

- Pre-verified IPs (PVIPs) are independently verified with a standalone UPF
- PVIPs are implemented at a higher level block, Automatic Place and Route (APR)
- PVIP UPF needs to be updated/refined with implementation details
- Intrusive methods are used for implementation refinement
 - Could invalidate the verified power intent

• Need a methodology

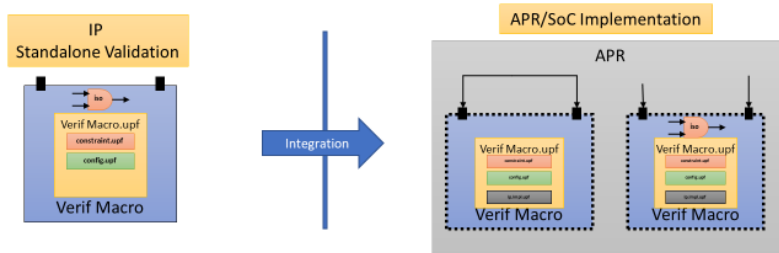
- That empowers tools to perform automatic checks
- Provide confidence to the users that the UPF changes to the PVIP are safe
- Ensure that the PVIP doesn't need re-verification

UPF Soft macros not sufficient



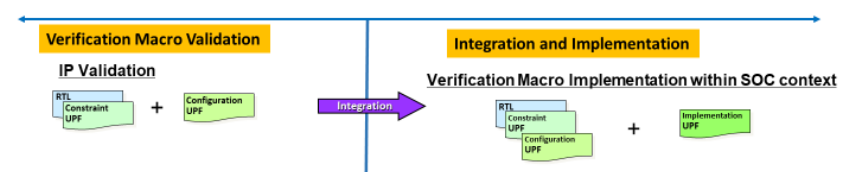
- Implementation UPF required for standalone implementation
 - Further updates not allowed during integration
- Cannot violate UPF LRM defined terminal boundary semantics
- Instance specific optimizations not possible
 - eg. Shorting of supplies will not remove redundant ISO cells (shown above)

Solution: Verification Macro



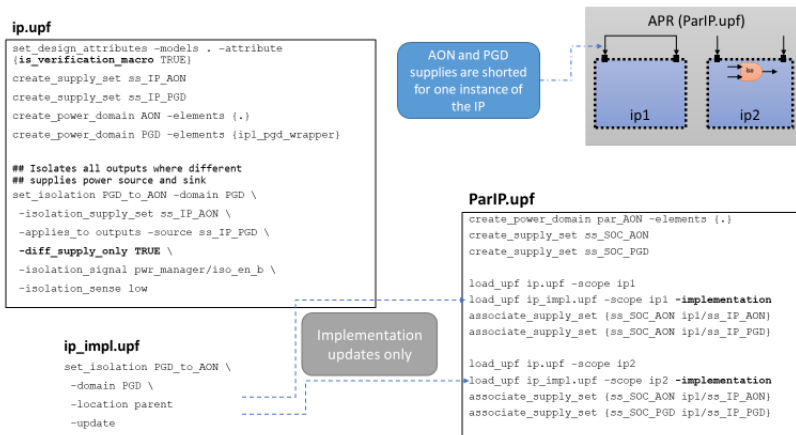
- Standalone IP implementation not required from IP provider
 - IP integrator can refine PVIP UPF with implementation details
- Relaxed UPF LRM terminal boundary semantics
 - Only updates which do not invalidate the verified power intent
- Instance specific optimizations allowed
 - eg. Tools can optimize redundant ISO cells based on shorted supplies (shown above)

Refinement of Verification Macro



- IP Integrator can only add Implementation details
- Only allow loading of two kinds of UPF for a given macro instance
 - load_upf ip.upf -scope ip_inst
 - load_upf ip_impl.upf -scope ip_inst -implementation
- The new option (-implementation) introduced
 - Enables tools to ensure only implementation updates for PVIP
- Restrictions are imposed on what commands/updates are allowed
 - Allow only limited commands/updates which enable adding implementation details
 - Requires a new option to load_upf to allow restricted update of implementation UPF

Example



Benefits of Verification Macro

- Tool flows and methodology
 - **Empowers** tools to compare and highlight deviations from original power intent
- IP Provider
 - Enables IP Provider to **abstract** the design with respect to power management
 - Implementation UPF not required
- SoC Integrator
 - Flexibility to **optimize** the power intent implementation
 - Ability to **refine** the power intent for a target technology
 - **Reuse** the validation done by the IP provider