IEEE Std 1547-2018 Interoperability Framework

Standardized Alternatives for 'Control Limited Capacity' and other terms

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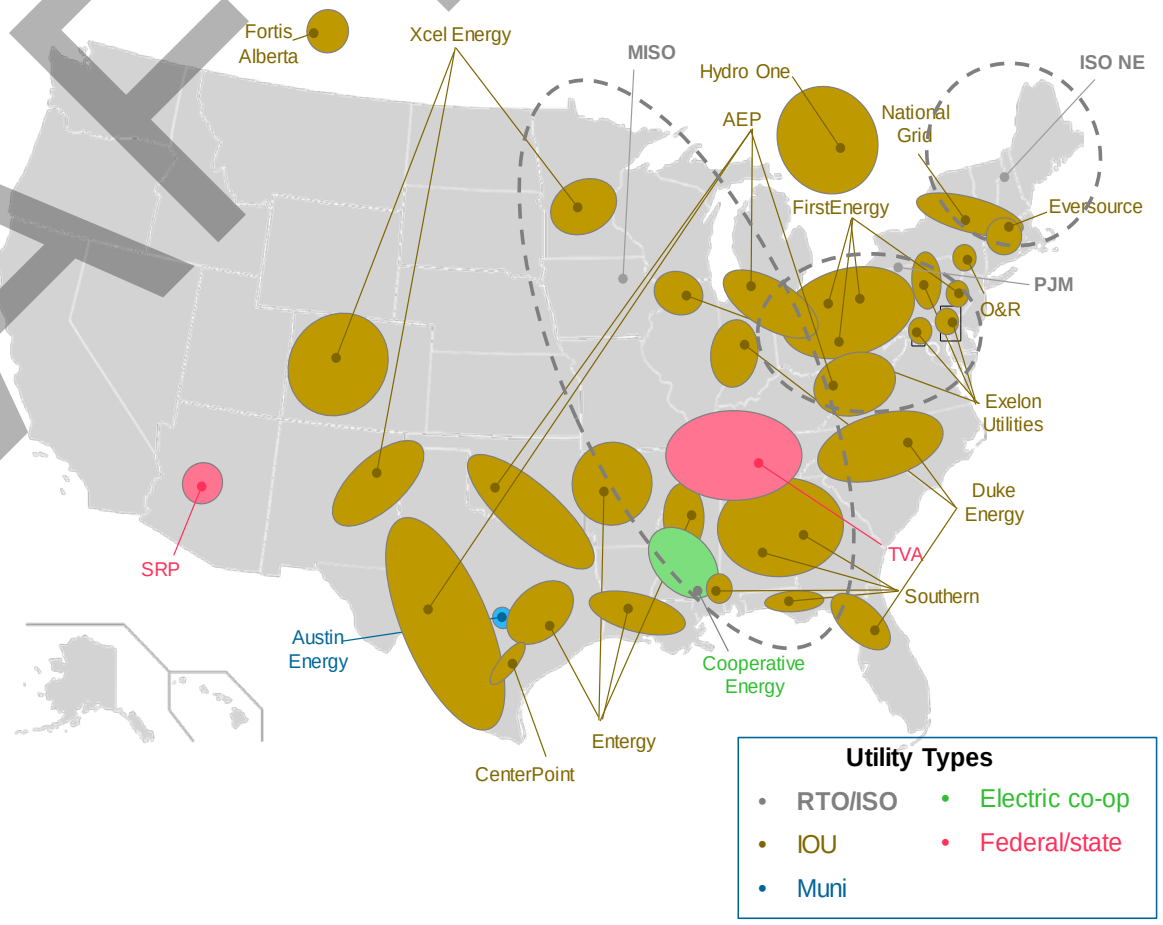
Navigating DER Interconnection Standards and Practices

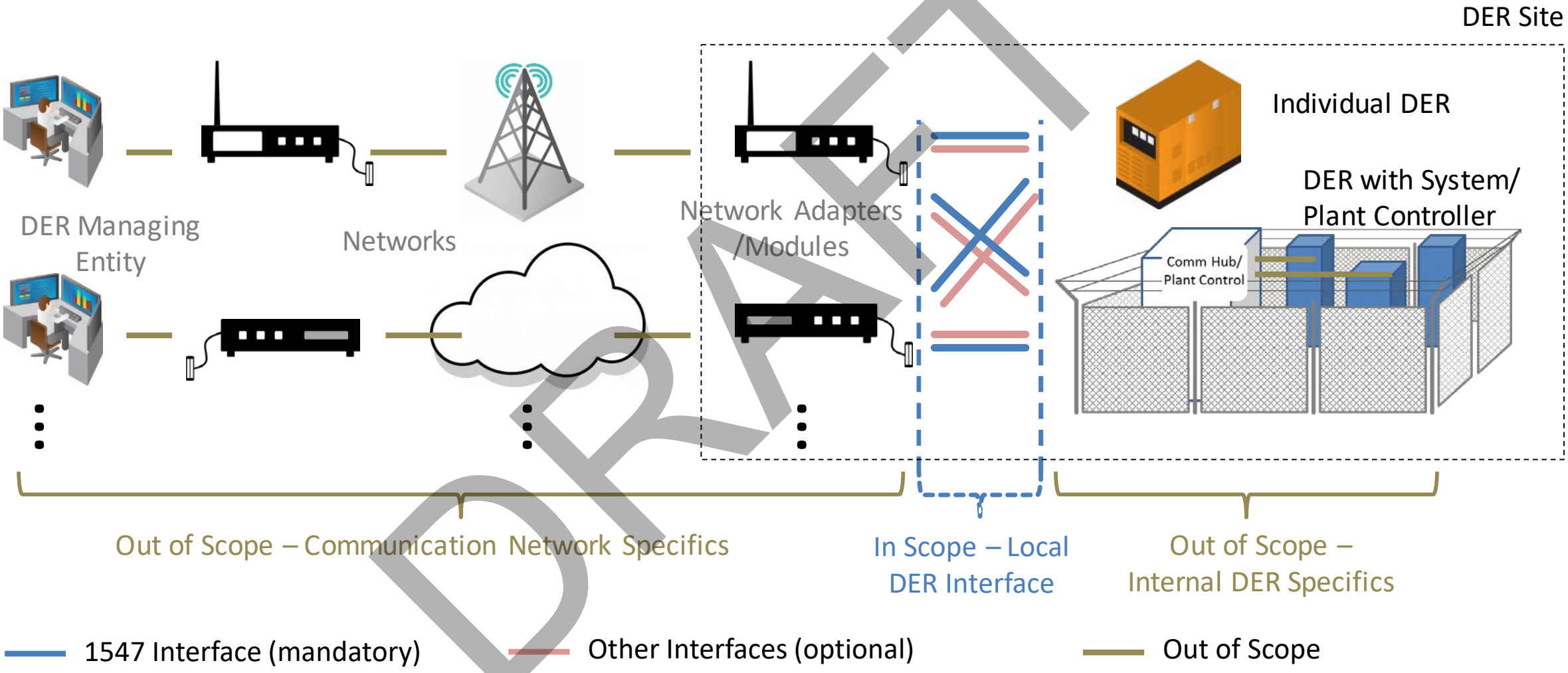
EPRI Supplemental Project and other Initiatives

- Need for development of a DER interconnection standards adoption roadmap
  - Getting ahead of DER deployment
- Need for education and knowledge transfer
  - Distribution and transmission owners/planners
  - State regulators, policy makers, others
- Collaborative learning opportunities in
  - EPRI project “Navigating DER Interconnection Standards & Practices” (near-term, EPRI members only)
  - IEEE P1547.2 (Application Guide for IEEE 1547) (mid-term, public stakeholders)

Utilities interested in the application of IEEE Std 1547-2018 in the short- or near-term



Ensuring DER communication *capability* through standardized protocols and interfaces



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- The language in 4.2 (Reference Point of Applicability) allows the requirements of the standard to be met at the PoC (DER unit) under certain conditions (zero sequence continuity, aggregate DER rating smaller than 500 kVA, and less than 10% Local EPS load).
  - That said, AGIRs (e.g., state regulators) can adopt IEEE 1547-2018 with the further specification that any composite DER that include energy storage shall meet the requirements at the PCC.

- IEEE 1547-2018's local DER communication interface relates to the reference point of applicability (RPA) which is - typically or if desired by the AGIR for all DER with ESS - the PCC and therefore applies to the interface of any composite DER (DER system), and not to the individual DER unit(s) themselves.
  - Hence, compliance with the new 1547 requires composite DER must have a DER plant controller that can exchange information through a local DER communication interface.
  - Communication and interoperability inside the composite DER is outside the scope of the standard.
  - Example for a composite DER is a residential PV plus storage system behind-the-meter that is controlled such that export to the Area EPS is zero.

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- Type testing and DER evaluation (design & as-built) per the currently revised P1547.1 will have to verify that the composite DER meets any performance requirements at the PCC that relate to parameters (configurable as well as manageable) specified in the interoperability Subclauses 10.4 (Configuration information) and 10.5 (Monitoring information).

- If the above axioms/interpretations were accepted for any DER that shall meet the requirements at the PCC, the terms in the table below may become synonyms.

- Given that IEEE 1547-2018 has been vetted by many stakeholders, discussions are expected to be simplified and may be reduced to the following key decisions:
  - Whether the basis is meant to be active power (kW) or apparent power (kVA)
  - Whether the time frame and performance requirements in 1547 are sufficient to address the respective distribution planning and protection impacts
  - Whether any "configured" nameplate rating below a defined threshold would allow the DER interconnection process of a given composite DER (DER system) to be expedited, e.g., by reduction of screening criteria or impact study assessment

Mapping of Industry Terms to 1547-2018 Interoperability Framework

IEEE Std 1547-2018	Basis	Time Frame / Impacts	Draft TIIR	IREC edit	Xcel edit	DEA
nameplate ratings	kW, kVA, kvar	Planning, protection				
distributed energy resource (DER)	./.	planning	Energy Storage System			
Load	./.	Planning				
Configuration setting per 10.4 (Configuration information) with regard to 10.3 (Nameplate information) apparent power maximum rating	kVA	planning		Maximum AC Capacity		
Configuration setting per 10.4 (Configuration information) with regard to 10.3 (Nameplate information) Active power rating at unity power factor (nameplate active power rating)	kW	planning			Control Limited Capacity	Maximum Export Capability (kW)
Configuration setting per 10.4 (Configuration information) with regard to 10.3 (Nameplate information) apparent power maximum rating equals zero	kVA	Planning, protection	Non-Export, Non-Exporting			
Failure to comply with 10.4 (Configuration information) with regard to 10.3 (Nameplate information) Active power rating at unity power factor (nameplate active power rating)	kW	Planning, protection		Inadvertent Export	Inadvertent Capacity Exceedance	

Mapping of Industry Terms to 1547-2018 Interoperability Framework

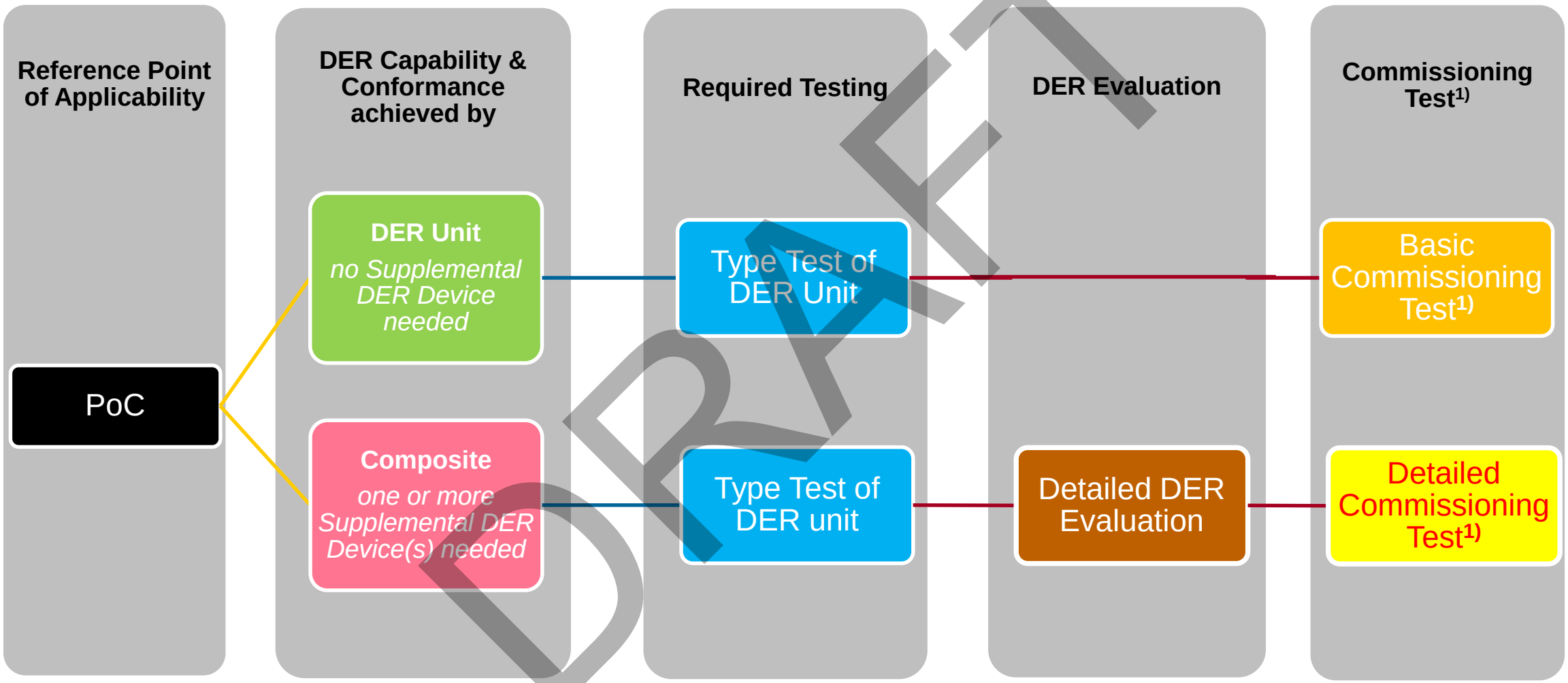
IEEE Std 1547-2018	Basis	Time Frame / Impacts	Draft TIIR	IREC edit	Xcel edit	DEA
4.6.2 (Capability to limit active power) with regard to a Maximum Active Power per 10.6.12 (Limit maximum active power)	kW	Quasi steady-state (approx. 30 s)		Limited export (note: it's noted that the limit may be dynamically adjustable, but IREC may suggest a different term for externally controlled limits)	Control Limited Export	
Failure to comply with 4.6.3 (Execution of mode parameter changes) and 4.6.2 (Capability to limit active power) with regard to a Maximum Active Power per 10.6.12 (Limit maximum active power) equals zero	kW	Quasi steady-state (approx. 30 s)	Inadvertent Export			

High-level test and verification process

Verification Requirement	Description
Type Test of DER Unit	A distributed energy resource (DER) unit that is type tested and compliant with the standard.
Type Test of DER System	A distributed energy resource (DER) system that is composed of DER units that are type tested and supplemental DER devices.
Basic DER Evaluation	A basic DER evaluation shall be limited to verify that the DER has been designed and installed with the proper components and connections.
Detailed DER Evaluation	A detailed DER evaluation shall include an engineering verification of the chosen components and may require modeling and simulation of the composite of the individual partially compliant DERs forming a system.
Basic Commissioning Test[1)]	A basic functional commissioning test includes visual inspection and an operability test on the isolation device.[1)]
Detailed Commissioning Test[1)]	A detailed functional commissioning test shall include a basic functional test and functional tests to verify interoperability of a combination of devices forming a system to verify that the devices are able to operate together as a system.[1)]

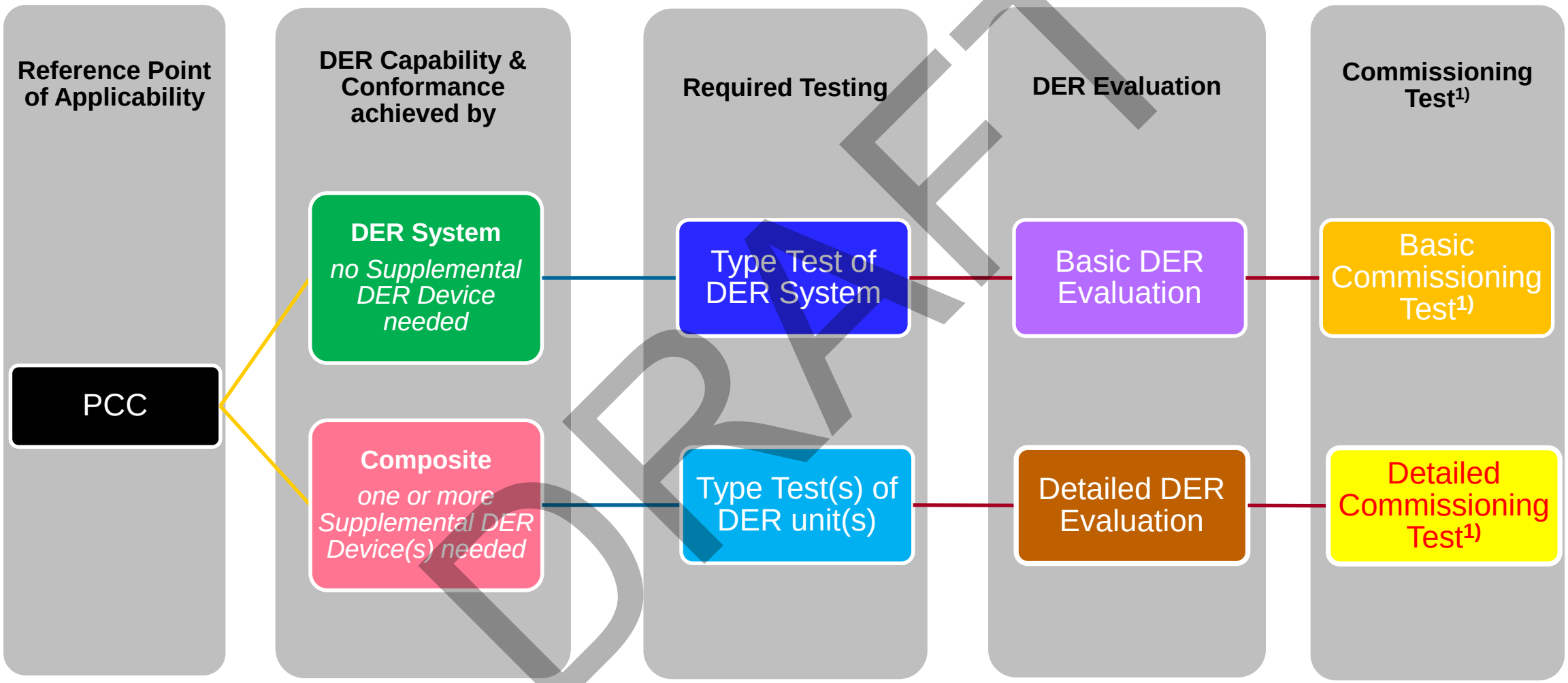
[1)] As applicable, may depend on DER Design Evaluation.

High-level test and verification process - PoC



1) As applicable, may depend on DER Design Evaluation.

High-level test and verification process - PCC



1) As applicable, may depend on DER Design Evaluation.

Summary and remaining questions

- It seems as if IEEE Std 1547-2018 provides a sufficient performance and capability requirements framework to address DER with energy storage and which (active or apparent) rating or power export was set or managed to less than the rating or available active power.

- However, the implementation and certification of this framework is dependent on adequate test and verification procedures as defined in P1547.1. Hence, the question is whether there may be a need for an interim solution during the time period where fully 1547-2018 compliant and 1547.1 tested equipment is not yet available?
  - The currently developed CRD on Power Control Systems may serve as a suitable interim solution.
  - UL should strive to harmonize the terminology used in that CRD with the terminology specified in IEEE Std 1547-2018. For example, the term of "inadvertent export" may not be used any longer in the future.

- The final question, therefore, is whether the test and verification of the Configuration setting per 10.4 (Configuration information) and the compliance with the 4.6.3 (Execution of mode parameter changes) and 4.6.2 (Capability to limit active power) with regard to a Maximum Active Power per 10.6.12 (Limit maximum active power) will be sufficiently addressed in P1547.1?