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Advanced Licensing and Safety Engineering Method – ADLAS[®]

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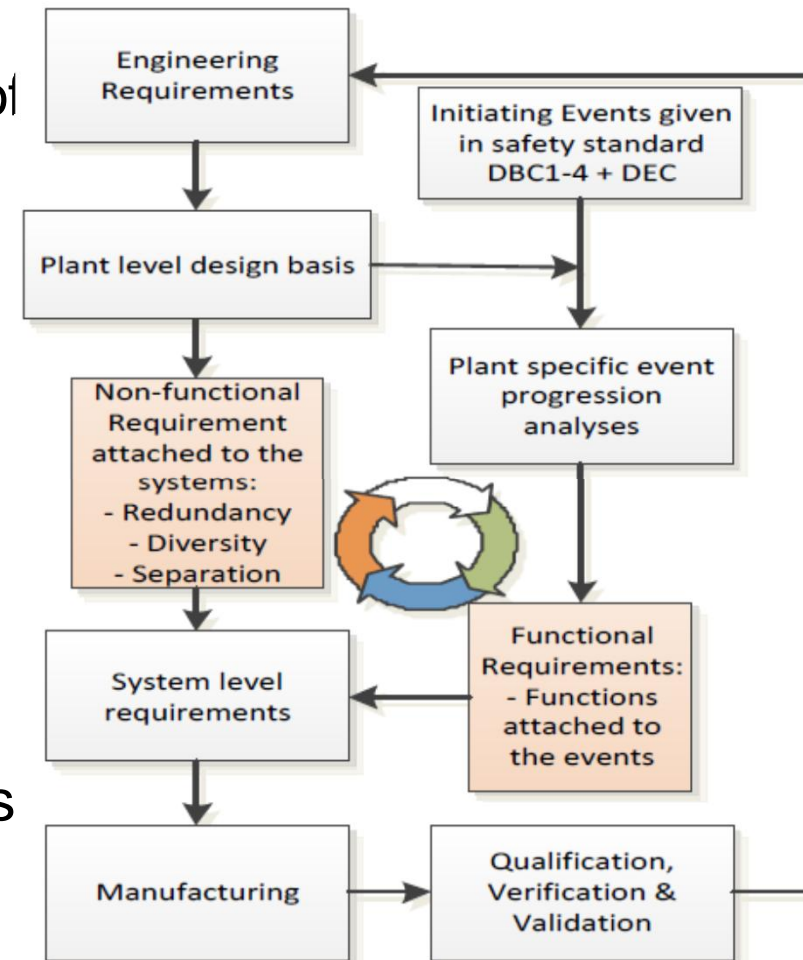
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Challenges in recent NPP projects

- Both new build and modernization projects have suffered from schedule and budget overruns in Finland but also in other countries
- There has been rather long depression in nuclear after TMI-2 and Chernobyl, but still some modernizations have been carried out during those years
 - Those who thoroughly know the original design basis have retired some years ago
 - Lack of competence is part of explanation
- Some new technologies, require different kind of approach for design process:
 - CCF of the software in digital I&C, can not be fully tested
 - Design process has to be transparent and traceable in order to meet reliability requirements of the highest safety level
- Also regulatory bodies have requested more systematic approaches to requirement management and configuration management

Traditional approach

- Traditional approach tried to give non-functional requirements directly to systems without hierarchy of requirements
- System level engineers needed to decide how to apply requirements related to:
 - Defense-in-depth principle
 - Redundancy and diversity requirements
 - Separation
- Description of design basis was rather vague
- On the other hand regulatory requirements are not (and they should not be) actual design requirements but they need to be interpreted
- This interpretation was not documented – only the end result was

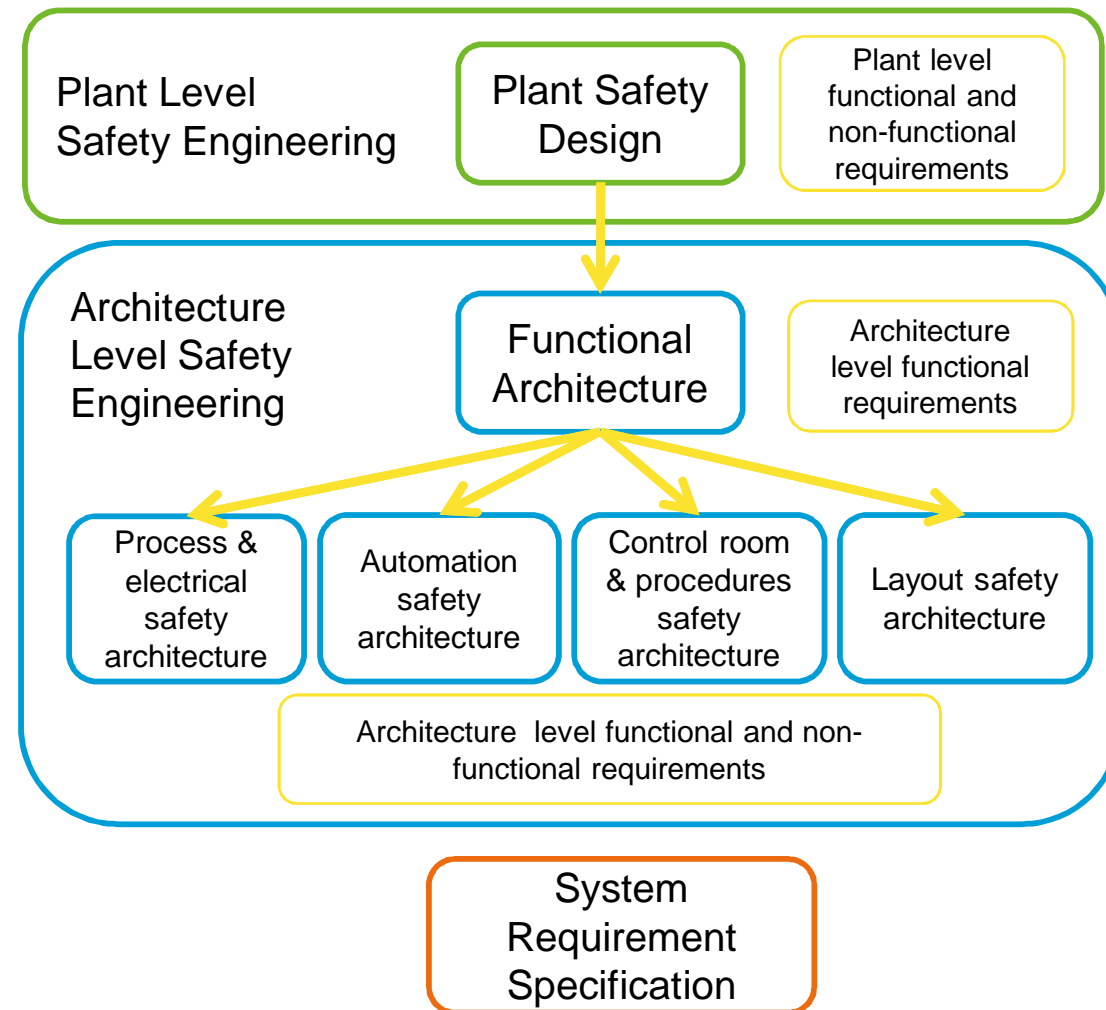


The new method

- New method was needed in Loviisa NPP I&C modernization to ensure successful project execution and to meet new regulatory requirements
- The idea is to give hierarchy and traceability for:
 - Design
 - Requirements
 - Verification and validation
- Originally developed for I&C, but later on adapted also for other disciplines
- Clear and transparent processes described in safety engineering plan
- Transparent requirement elaboration from regulatory requirements to actual design requirements in different levels of hierarchy

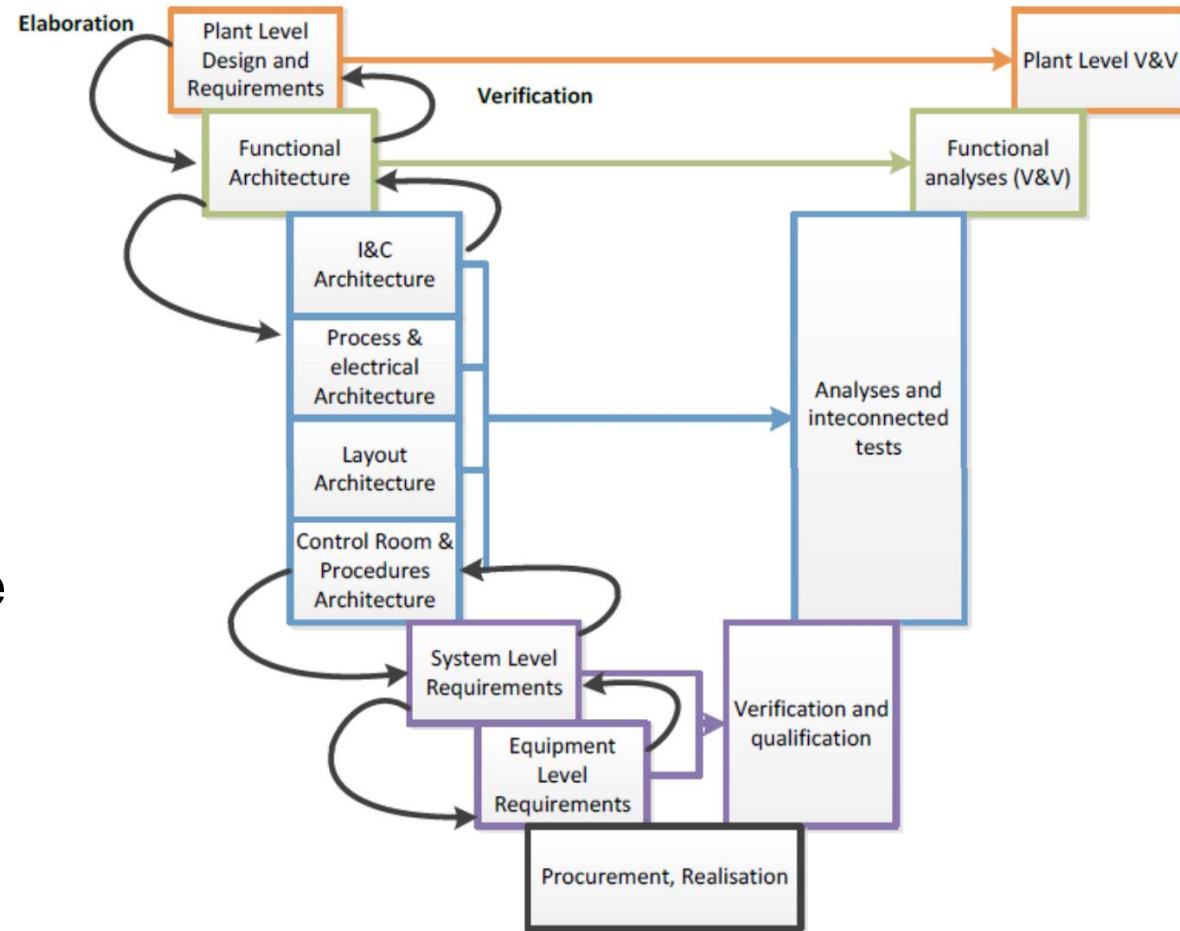
Engineering hierarchy of ADLAS® method

- Plant level gives functional and non-functional requirements to functional entities.
- Functional architecture assigns safety functions to initiating events.
- Technical architecture is the system of the systems. It assigns safety functions to systems and give requirements to system interfaces
- System level requirements are presented in SRS's
- Traceability is provided to upper levels and to native requirements



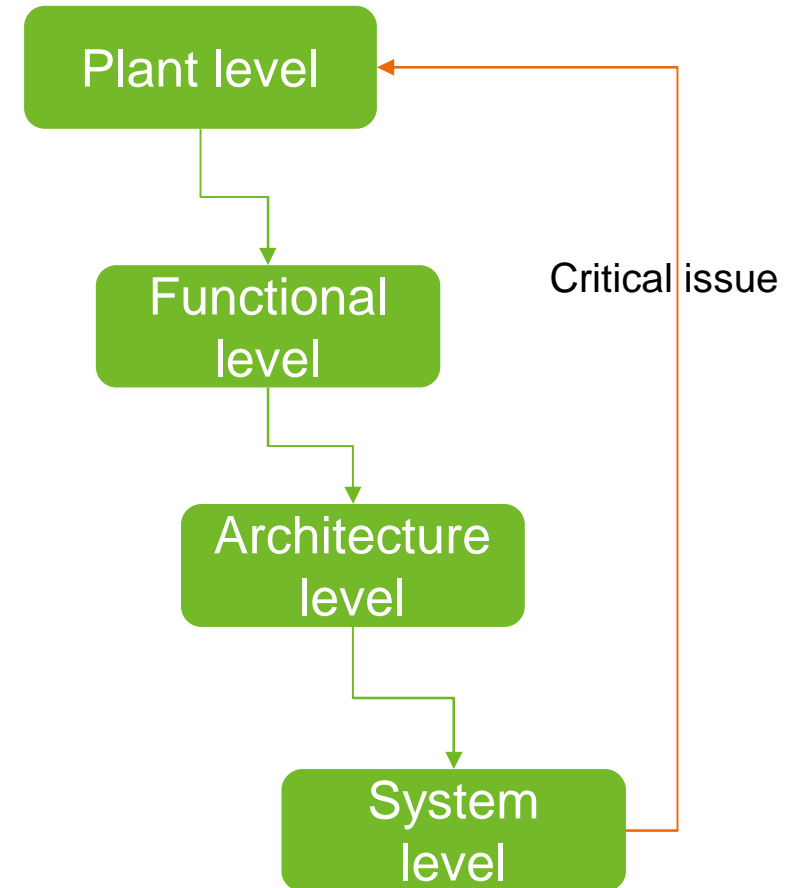
V&V hierarchy of ADLAS® method

- If the design has a hierarchy so why then V&V activities would not have the same hierarchy?
- Plant level requirements needs to be validated in plant level etc.
- Also, the role of each V&V activity becomes more clear and justification of scope should become more transparent.



Both-ends-meet-at-middle

- In some product lifecycle management models, requirements are brought from bottom up
- Some of them bring requirement for top to down
- ADLAS applies both-ends-meet-at-middle, where already known critical licensing issues are brought from system level to plant level so that hot licensing or safety topics are handled first and the "ordinary" topics are handled in the respective level
- This has been proven to be the most effective and successful approach



Requirement management

- Requirements are traced back to regulatory or other native requirements in upper level documents
- New requirements may be elaborated from the natives or from the upper level requirements in the lower level documents
- Lower level requirements are elaborated already in upper level document
 - -> "automatic" verification
- Database is used to filter upper level requirements to lower level document
- Method for V&V has to be considered already when elaborating the requirement
 - Conformance with requirements is more probably from method point of view

Advantages of ADLAS® method

- Transparency provided by the method takes forward the safety level and understanding the safety philosophy of the facility:
 - Knowledge transfer both in time and between technical disciplines
- Transparency may help in regulatory approval:
 - Regulator knows what technical information is expected in certain document and addresses request of additional information in to the right level.
- The method meets formal requirements
 - Method does not help if the design is not correct, but it transparently shows the design requirements and gives traceability for them