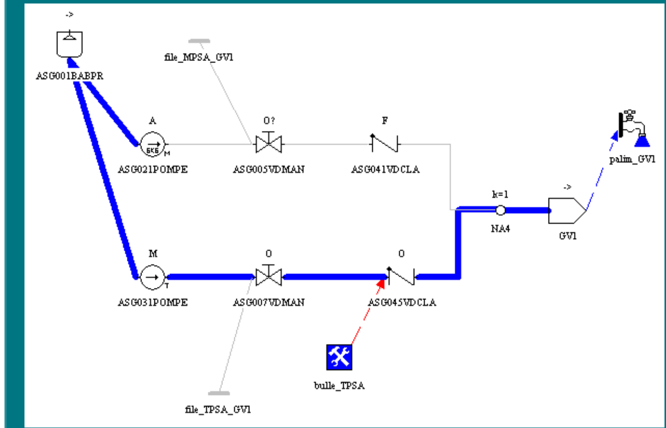
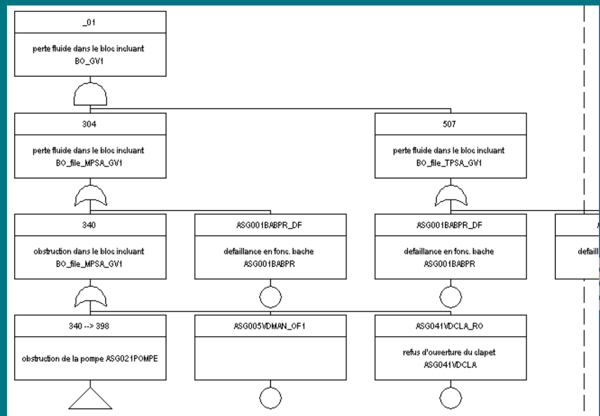




PSA Tools : a user perspective

Mohamed Hibti, Richard Quatrain
EDF R&D, Clamart, France

PSA workshop
June 12th, 2007

Context

Large PSA models

- Example of the EDF RiskSpectrum 1300 Mwe model
    - 4600 basic events
    - 300 event trees
    - 8000 sequences
    - Fault trees more than 16 page levels deep

Managing PSA skills

- A new generation of PSA analysts
- Quick Human resources turn-over (EDF and providers)
- Cost control of the activity

➔ Risk of too complex models

Complex models, or large models ?

EDF RiskSpectrum N4 model

- Numerous specific event trees, highly developped : 500 event trees, 29000 sequences
- Model size difficult to handle : computability, maintainability

Relcon analysis / recommendations

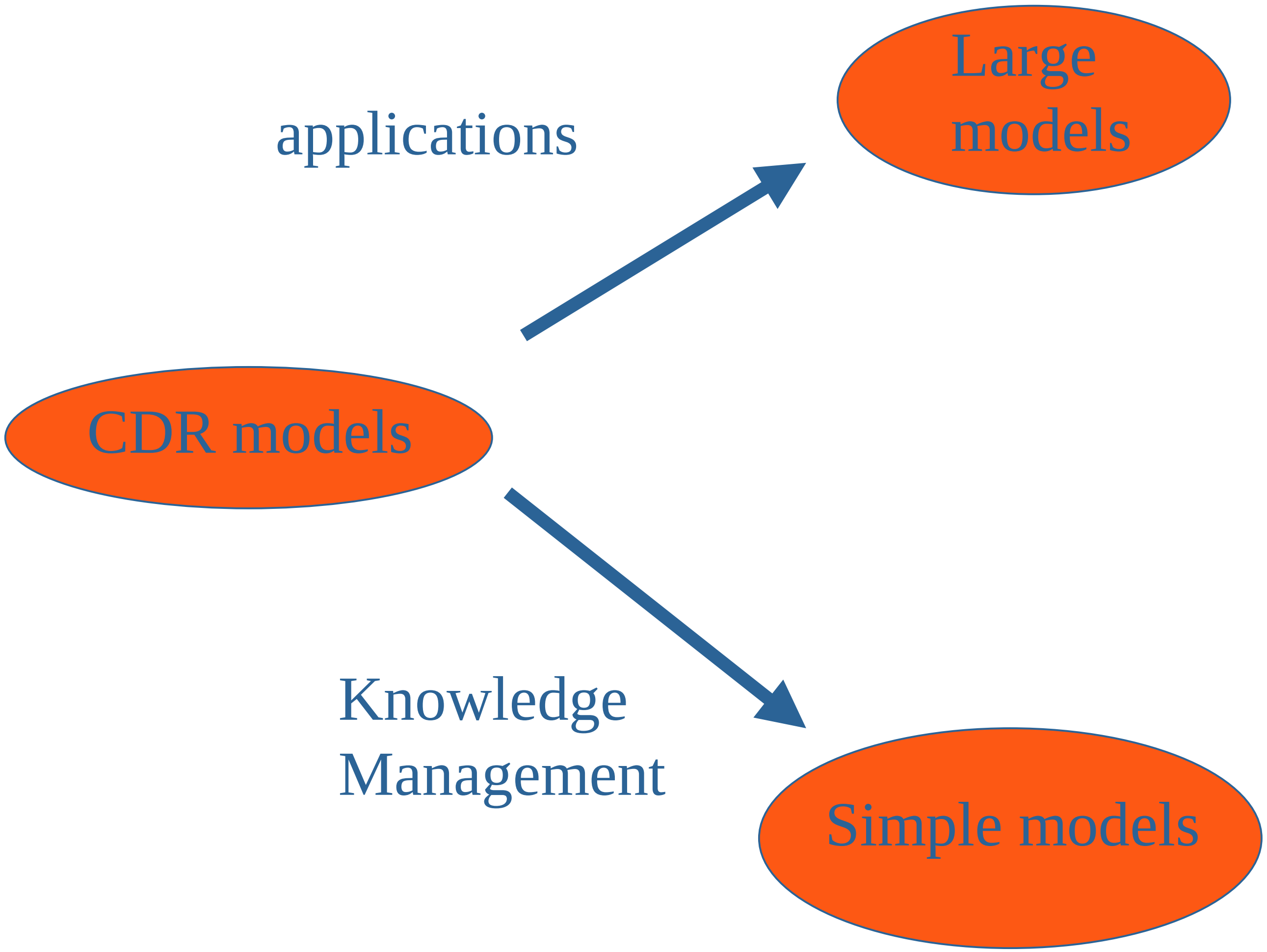
- Short term : switch to RS32, which will be better at large models
- Long term : reduce complexity of the model for easier maintaining
    - Generic event trees
    - Child event trees

EDF original recommendation for detailed event trees

- Detailed operating mode description to fit with Technical Specification
- Detailed description of consequences (level 2 PSA)
- Clear and unambiguous event trees

➔ A will of simplification

Opposite trends



Large models: a necessity

Applications

- Operating procedures, level 2 PSA, RIF, Risk Monitoring, Periodic tests

Scope

- Fire PSA, Agressions

Realism

- Refining of first approximations
- Fine tuning with operating modes
- Dependancies (I&C and Human missions, power supply)
- Dynamic reconfigurations

Using the model: confidence in the tool

Handling real size problems

- Robust algorithms : calculations in a reasonable time
- Reliable data storage
- Data representation : ergonomy and reasonable machine resource

A reasonable approximation

- Description of the algorithm
- Proved error interval
- The results have to be as expected : help for interpretation
- Standard use cases, shared by the PSA community, with consensual results
- Export format: comparison with other tools

Using the model : answering questions

Getting results

- Parametric export of results in reports
- Navigating (cut sets to sequences): Interpretation, debugging

Go further with other tools (graphics, sensibility calculations, dynamic systems)

- Accuracy for reference models, and for applications as well

Navigating facilities

- Follow any link of the model (FT $\leftarrow\rightarrow$ FE $\leftarrow\rightarrow$ ET)
- Link with documentation

Easy updating of the documentation

Modeling : formalism

Ability to represent a complex reality

- Configurations (operating modes, failure options)
- Dependencies
- Dynamic behaviours

Semantics fit to incidental/accidental situations knowledge

- Consensual understanding within the user community
- Limited to possible events (event trees branches)
- Independance from the algorithm, from the tool

Clarity

- Easier maintaining/verification
- Explicit choices of modeling
- Trace and control simplifications / asumptions

Modeling : allows context adaptation

Simplification by implementing a context

- Setting options (operating modes, failures)

Dynamic re-designing of trees according to context

- Color conventions, pruning of trees
- Explicitation of alternatives

Profile / Configuration tools

- Defining profiles / variants
- Setting profiles and combining variants while navigating

Modeling : allows generalization

Various representations for various users:

- PSA Developper
- PSA analyst (Applications)
- Less PSA initiated people

Need of a compact representation

- Generic event trees
- Modularization in FT
- System representations rather than Fault Trees (EDF tool KB3)
- Main probability criteria

EDF R&D

Conclusion

Avanced features need

- A powerful interface
  - Dynamically switching levels of representation, options
- Data structure allowing nested modeling
  - XML format, XML database
- Standard modeling
  - Sharing of efforts, insights
  - Common tools for visualization

Simple vs. Detailed models?

- We want both ☺