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A Defence Standards decision support tool: a Bayesian belief network approach

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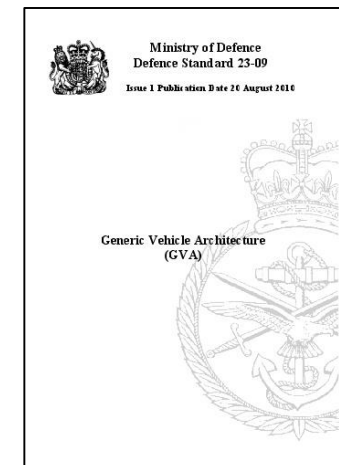
An Example

- Body Armour



Be wise ... Standardize! **NSO**

- **Standard**
 - “an agreed way of doing something”
 - Provide reassurance about quality & performance of products & services
- **Different types**
 - UK DefStan
 - US MilStan
 - NATO STANAG
 - Civil





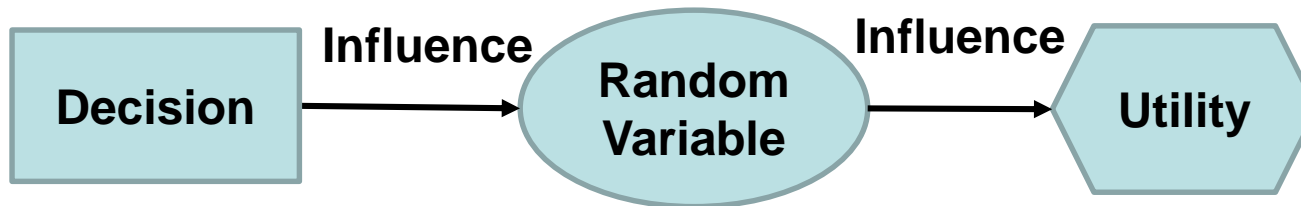
- Responsible for standards within UK MOD
- Costly to produce & maintain DefStans
- “As civilian as possible, only as military as absolutely necessary”
- Intelligent user of standards

- Do you need a standard at all?
 - If so, which one?
 - What are the consequences?

- 2014 Scoping Study
 - Explored assessing value of standards
- 2015 Proof-of-Principle Study
 - Bayesian Belief Network (BBN)
- 3 Case Studies
 - Body armour
 - Vehicle electronics
 - Ship radios



- Causal probabilistic network



$$P(A|B) = \frac{P(B|A) P(A)}{P(B)}$$

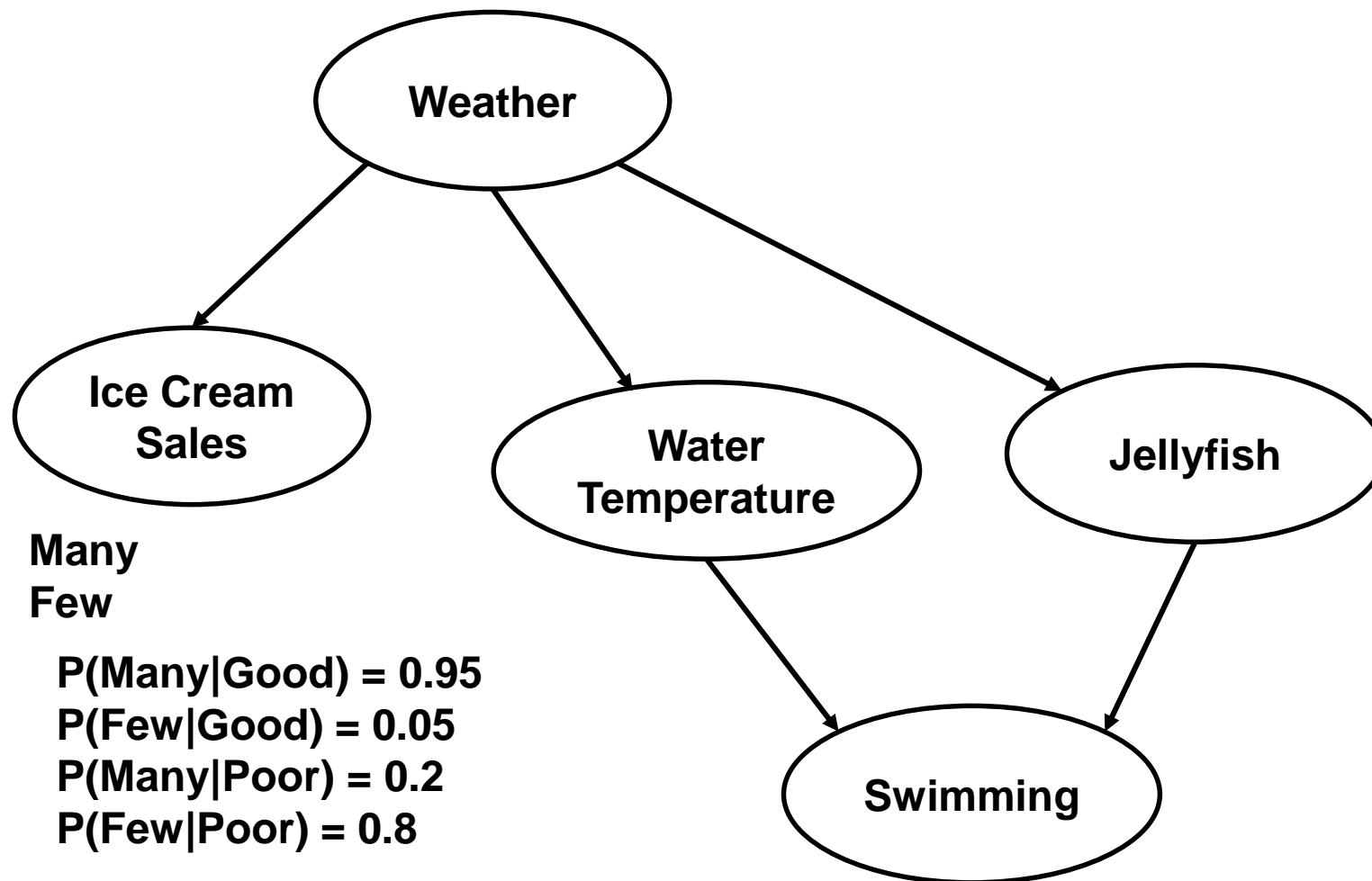
Bayes Theorem

- Advantages

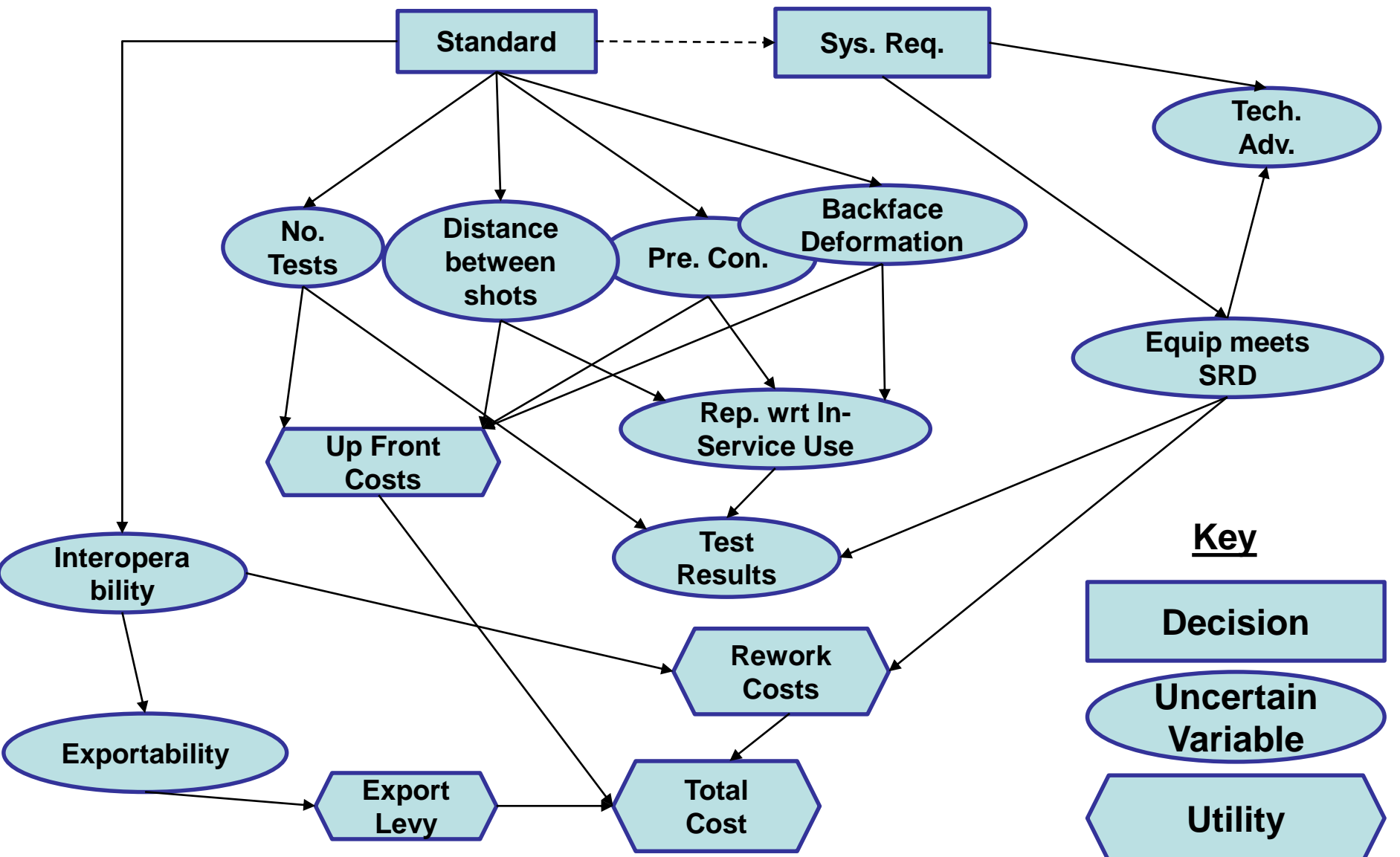
- Visualise dependencies
- Estimate likelihood of variable being in given state based on all available information
- Propagate information & complex calculations
- Conflicting evidence

Simple BBN

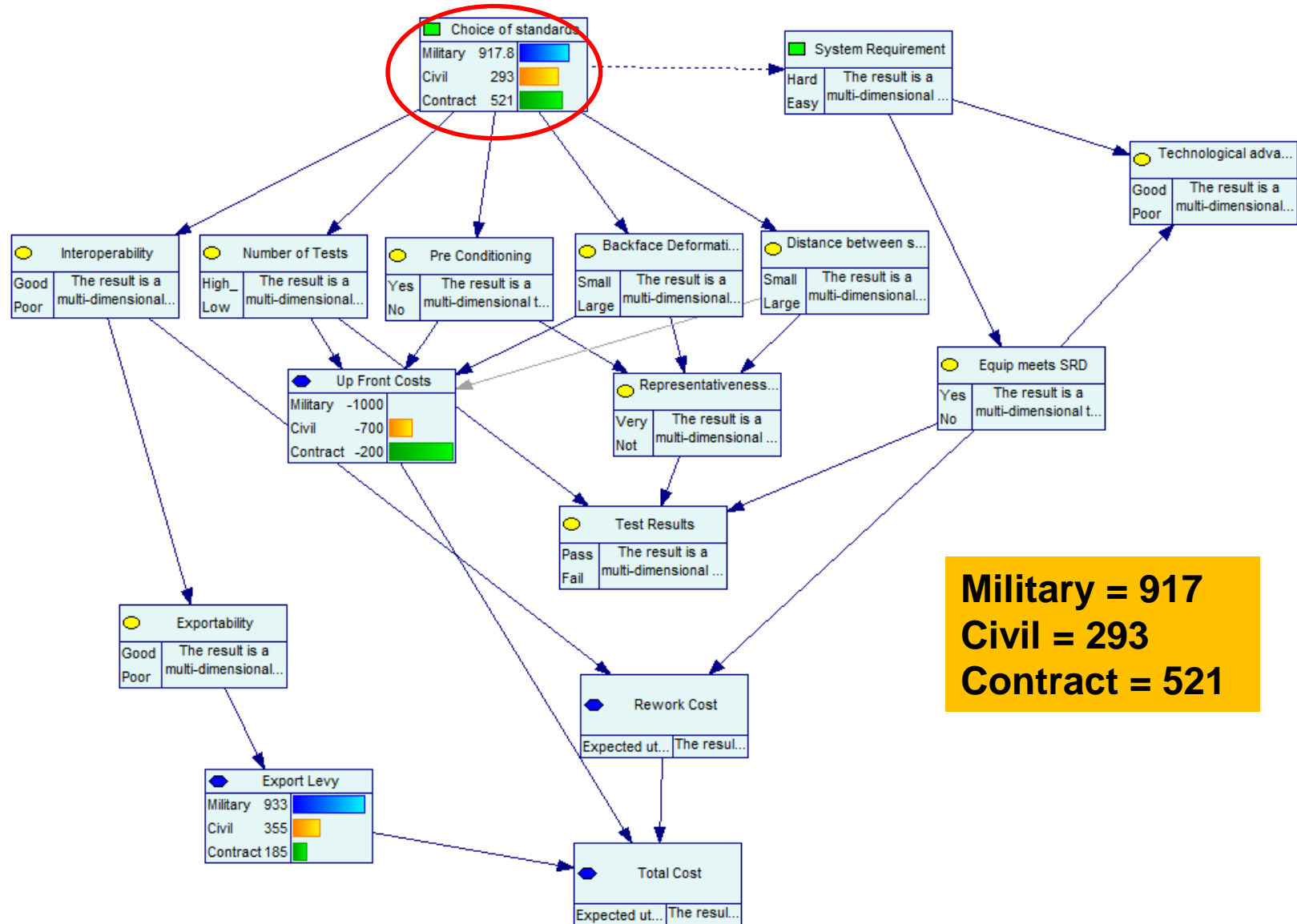
Good $P(\text{Good}) = 0.4$
Poor $P(\text{Poor}) = 0.6$



Body Armour BBN

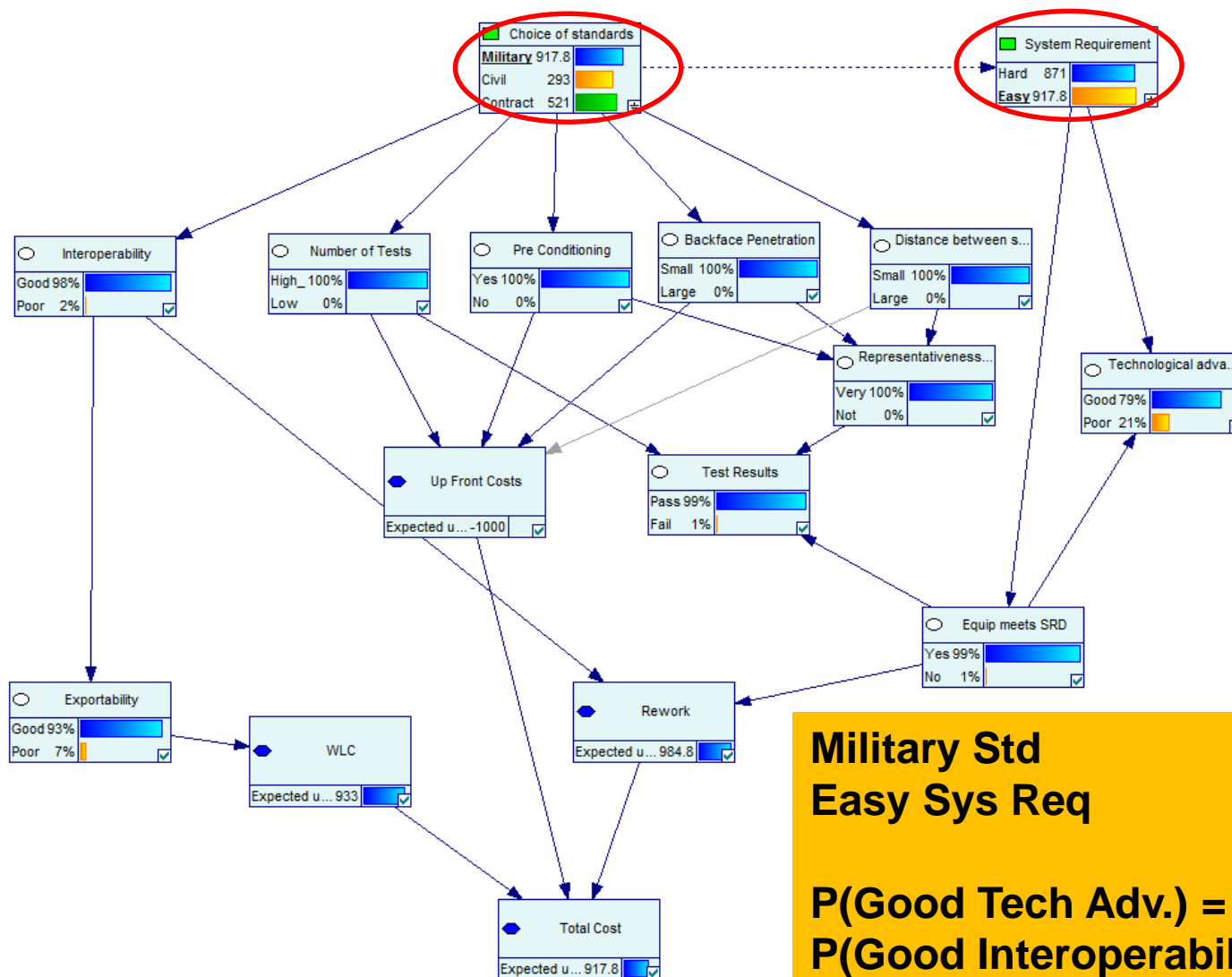


Which standard?



Military = 917
Civil = 293
Contract = 521

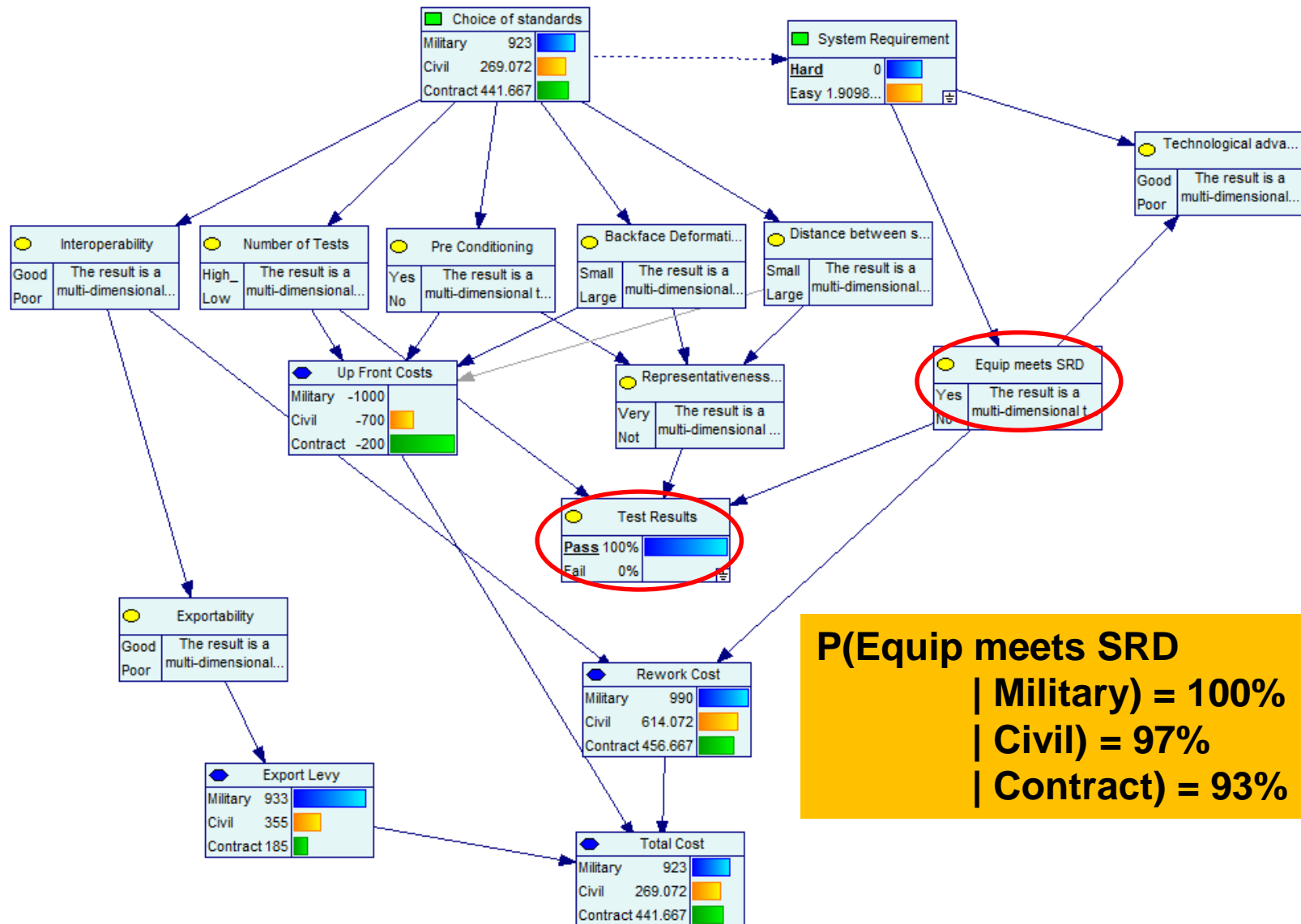
How strict should we make the requirement?



Military Std
Easy Sys Req

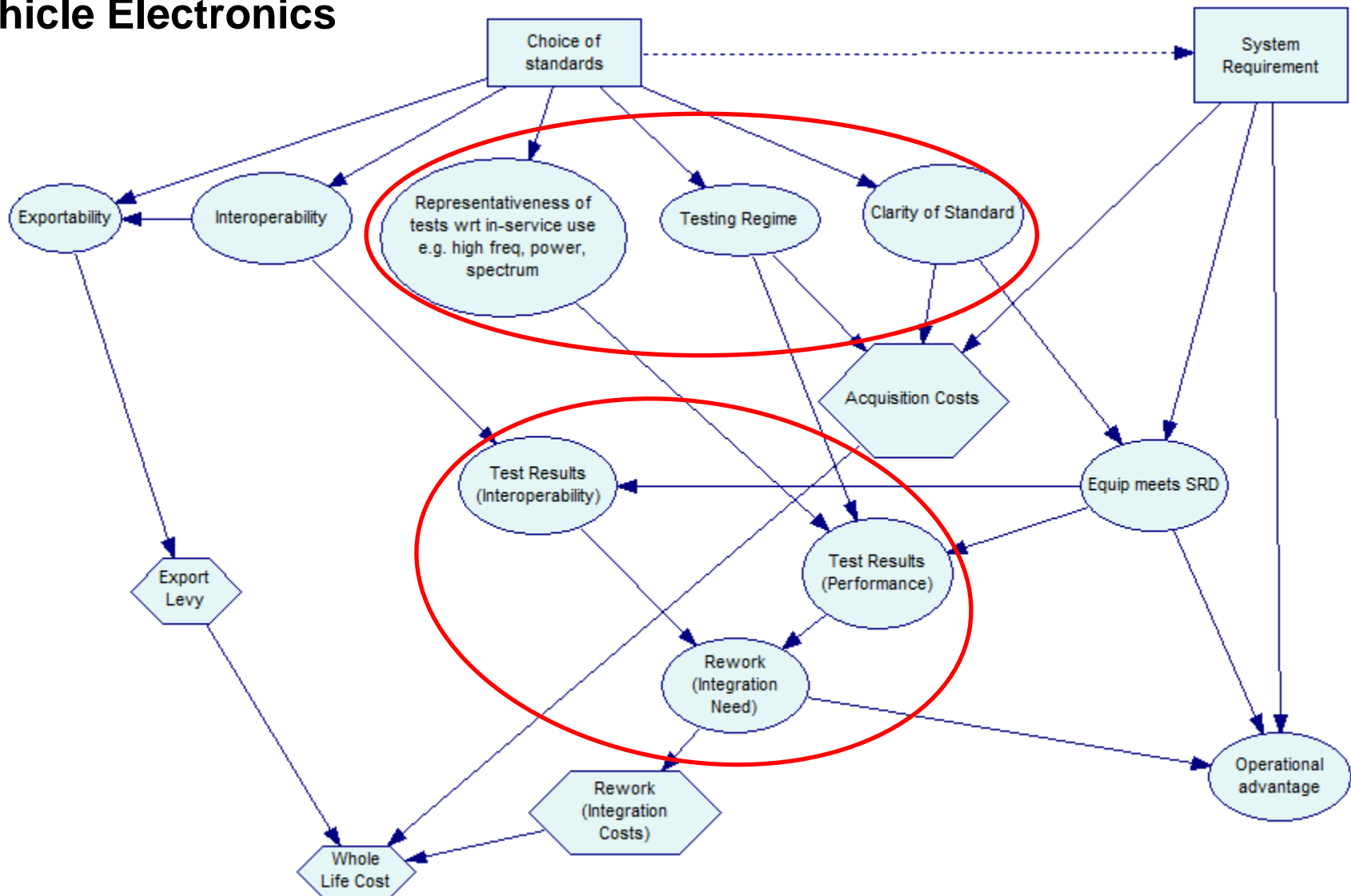
P(Good Tech Adv.) = 79%
P(Good Interoperability) = 98%
Total Cost = 917

How much confidence?



A Further Case Study

Vehicle Electronics



- Facilitation
- Node definitions & relationships
- Time commitments
- Decision maker v SME
- Estimating probabilities
- Results unintuitive

- BBN is a flexible, feasible method for evaluating & comparing standards
 - Further work required to fully explore utility
- Long term
 - Embedding decision support tool
 - Intelligent user of standards
 - Evidence based decisions



Thank you
Questions?

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