

CHALLENGES

- How can I determine whether my installation is reliable or not?
- How can estimate the service life?
- When should I migrate and why?
- What can I do to delay the end of life?



CONCEPTS AND DEFINITIONS

• LIFE CYCLE:

- WIKIPEDIA: "The stages in the lifespan of a commercial product."
- "It describes the stages a **product** goes through from when it was first thought of until it finally is removed from the market. Not all products reach this final stage. Some continue to grow and others rise and fall." (Concept, planning, Execution, growth, maturity, decline).
- SERVICE LIFE: "A product's service life is its expected lifetime, or the acceptable period of use in service. It is the time that any manufactured item can be expected to be 'serviceable' or supported by its manufacturer".



FAILURE RATES DIAGRAM





SERVICE LIFE ENDS AT THE BEGINNING OF WEAR OUT PHASE





CONCEPTS AND DEFINITIONS

- MTBF: "Mean time between failures (MTBF) is the predicted elapsed time between inherent failures of a system during operation. MTBF can be calculated as the <u>arithmetic mean</u> (average) time between <u>failures</u> of a system. The MTBF is typically part of a model that assumes the failed system is immediately repaired.
- MTTF: Mean time to failure. It measures average time to <u>failures</u> with the modelling assumption that the failed system is not repaired (infinite repair time)."



MTBF APPLIES IN THE PHASE OF RANDOM FAILURES ONLY





THREE LEVELS TO EXTEND SERVICE LIFE FROM CORRECTIVE MAINTENANCE





THREE LEVELS TO EXTEND SERVICE LIFE AND PREVENTING MAINTENANCE





THREE LEVELS TO EXTEND SERVICE LIFE TO MIGRATION





AVERAGE LIFE SPAN OF HARDWARE IN AUTOMATION SYSTEMS

Calculation constraints:

- No available data about wear&tear of electronic equipment
- Extrapolation of available statistical data
- Correction factor from the manufacturer



AVERAGE LIFE SPAN OF HARDWARE IN SIEMENS AUTOMATION SYSTEMS

ABOUT

- 5-7 years for HMI
- 12 years for PLC (CPU, FM, CP)
- I6 years for I/Os
- 16 years for Power supplies (not batteries)



MIGRATION STRATEGY FACTORS

Predicted product service life.

Most important factor. Estimate of time that the product will work without an increment of probability of failure.

Evaluation of the ability to repair

Estimate of available resources and time needed to overcome a failure. A low ability to repair implies necessarily a conservative replacement strategy.

Effort and cost in case of production downtime

Estimate of the impact of failure on the installation in terms of cost associated to the production downtime and effort to re-establish nominal conditions.

Dependencies and compatibly with extensions (evolution)

This factor comprises the evaluation of compatibility constraints due to technology evolution of an old installation as well as compatibility constraints of the new technology chosen in case of migration.

Spare parts availability

Relationship between service life and product life.

Successors availability and compatibility

Compatibility and integration effort of the new technology into the remaining subsystems.

Service availability due to aging workforce.

Not only the technologies become out-phased but also the workforce required to maintain it. A good migration strategy takes into account the status of the workforce concerning the new technology and its ability to adapt.



OBSOLESCENCE STUDY @ CERN. THE DSS USE CASE

- DSS. Detector safety system. LHC experiments equipment protection.
- Highly critical
- 7 systems in production
- Commissioned in 2004.
- Based on redundant Siemens S7-400 CPU + S7-300 IO modules in Profibus



OBSOLESCENCE STUDY @ CERN. THE DSS USE CASE

- Predicted product service life.
 End of service life.
- Evaluation of the ability to repair. Low impact Spare parts onsite repository. Stand-by service. Experts on call.
- Effort and cost in case of production downtime. Very high impact
 Estimate of the impact of failure on the installation in terms of cost associated to the production downtime and effort to re-establish nominal conditions.
- Dependencies and compatibly with extensions (evolution). Low impact No major dependencies with other systems.
- Spare parts availability. High Impact S7-400 OK. S7-300 to be discontinued soon.
- Successors availability and compatibility. Average impact CPUs fully compatible. S7-1500 IO modules average compatibility . New Profinet network.
- Service availability due to aging workforce. Low Impact Team renewed. Similar technologies

