Toward
Practical Use of Assurance Cases: Definitions, Methods, and Tools.

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Contens

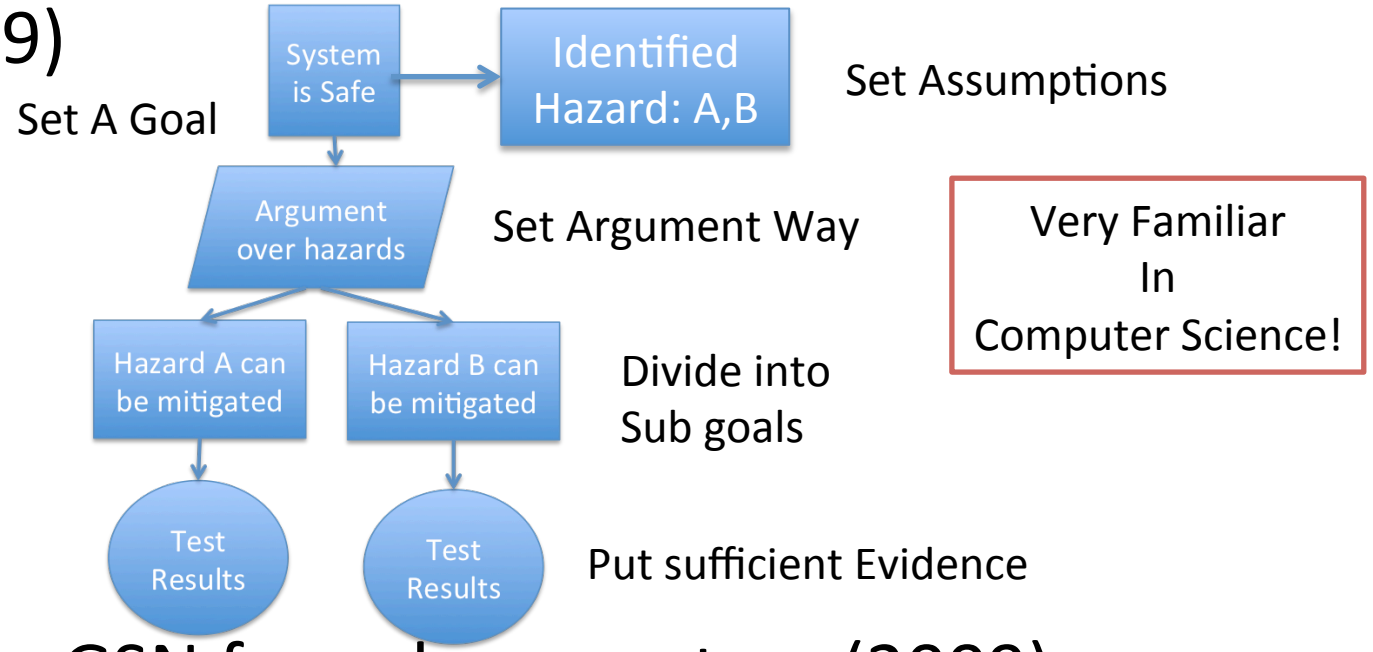
- D-Case Project – Assurance Case Project in Japan
- AC Working Library in Japan
- Tool
- Concluding Remarks

D-Case Project

- Assurance Case Project in DEOS (Dependable Embedded Operating System) project funded by Japan Science and Technology Agency (2010-2015)
  - D: Dependability
- DEOS Consortium D-Case Working Group
  - Nihon U、Nagoya U、Fuji Xerox、Naist、Tokyo U、Denso Create、Change Vision、Mitsubishi、Aizu U、…

Assurance Cases

- Recognized after serious incidents such as Piper Alpha (1989)



- Wrote AC in GSN for a demo system (2009)
  - Japanese Industry Expected AC as a common language inside and between companies

Challenges of AC

- When, who write and evaluate?
- Claim and argument structure setting
  - System is acceptably safe, dependable,…
  - Argument over lifecycle phases, system structure?
- Granularity、Size
  - Write reliability of a resister?
  - System becomes huge → AC becomes huge?

Most challenges were unsolved,
so we started D-Case Project

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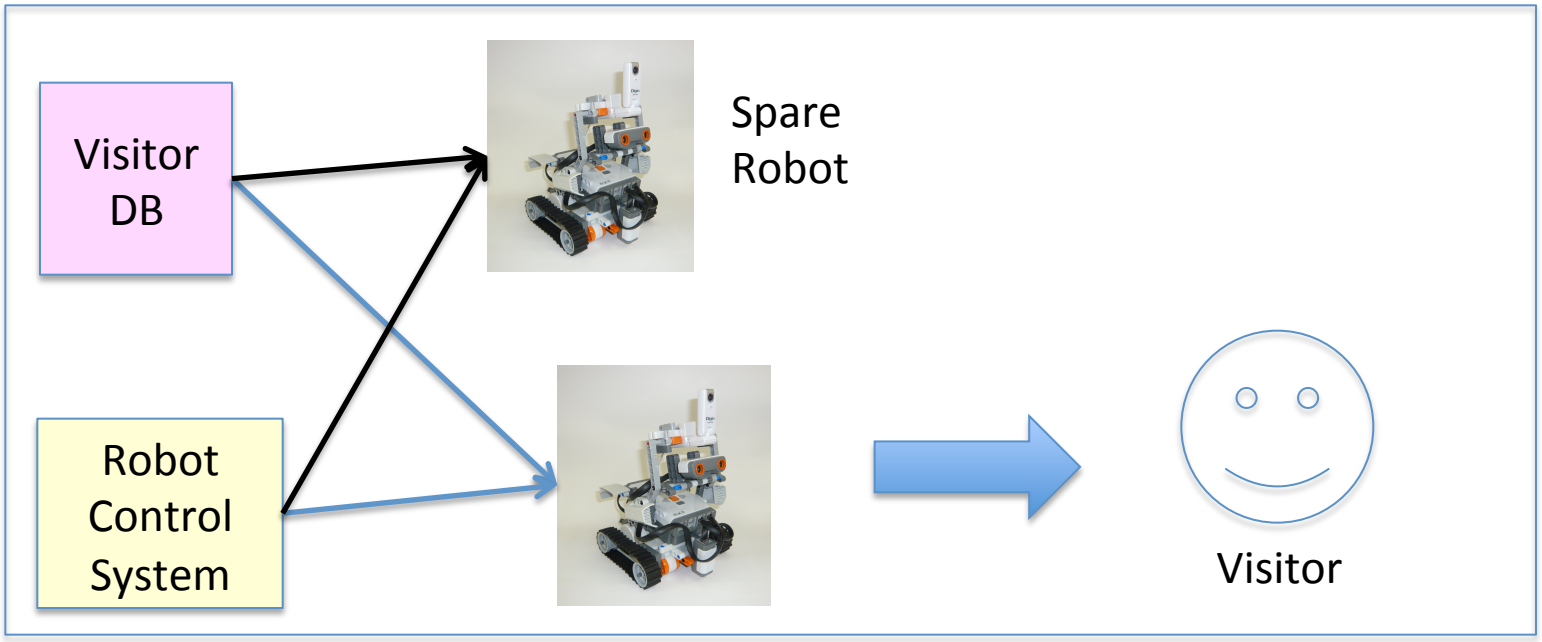
AC working library in Japan

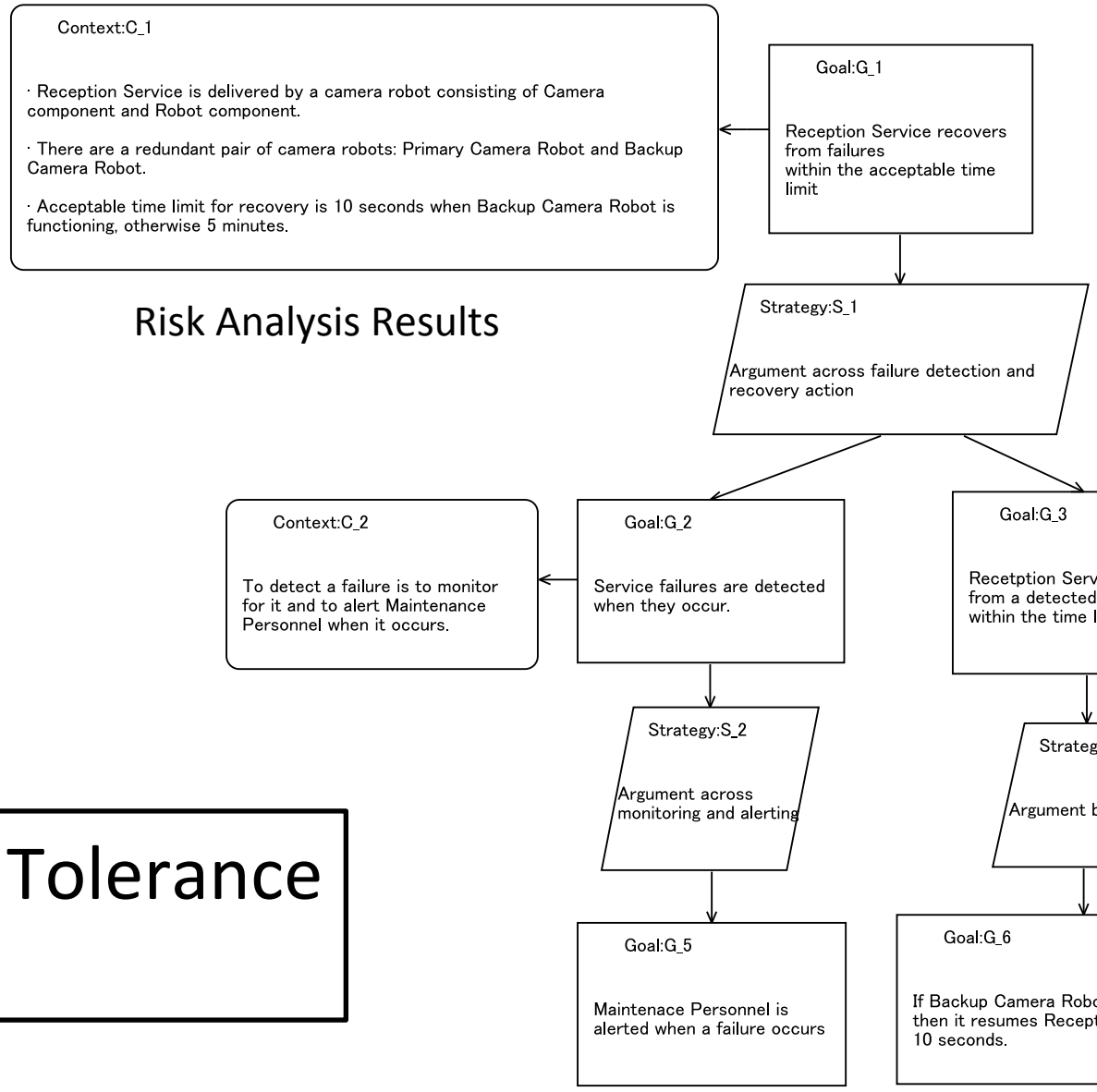
- Over 50 ACs in GSN since 2010, www.dcase.jp
- Size
  - 10 - 200 nodes, Ave. 63.5　(SD: 47)
  - 2 - 6 Depth, Ave. 4.1　(SD: 1.03)
- Contents
  - Fault Tolerance AC
    - DEOS Demo System
  - System Safety, Dependability AC
    - ISO26262、Automotive、Micro Satellite、
  - Situational AC（Specific Context, Stakeholders, Goal）
    - Mitsubishi Elect., Denso Create, Fuji Xerox, …

AC 1: Reception Robot Fault Tolerant (2010)

- Prepare a spare robot, and implement Fail-Over mechanism. By Fail-Over, in most cases, visitor only needs to wait 10 seconds when a failure occurs. In worst case (both robots are unavailable), visitor must wait 5 minutes.
- Goal ``Robot recovers from failures within acceptable time"



Top Level



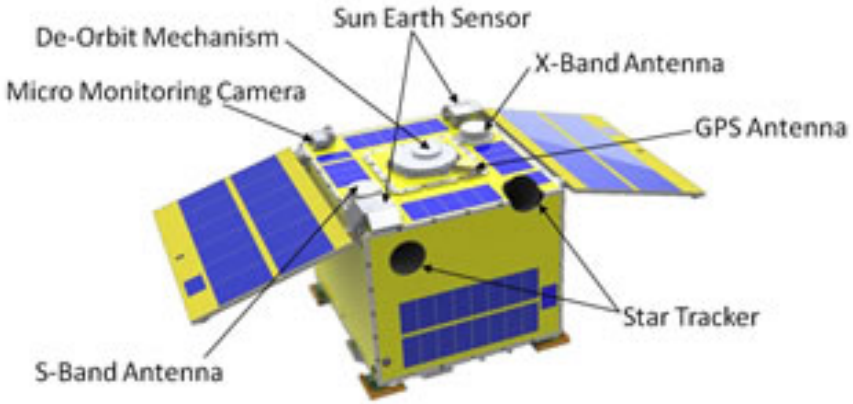
Risk Analysis Results

Effective for Explicitly Presenting FT mechanism

Fault Tolerance AC

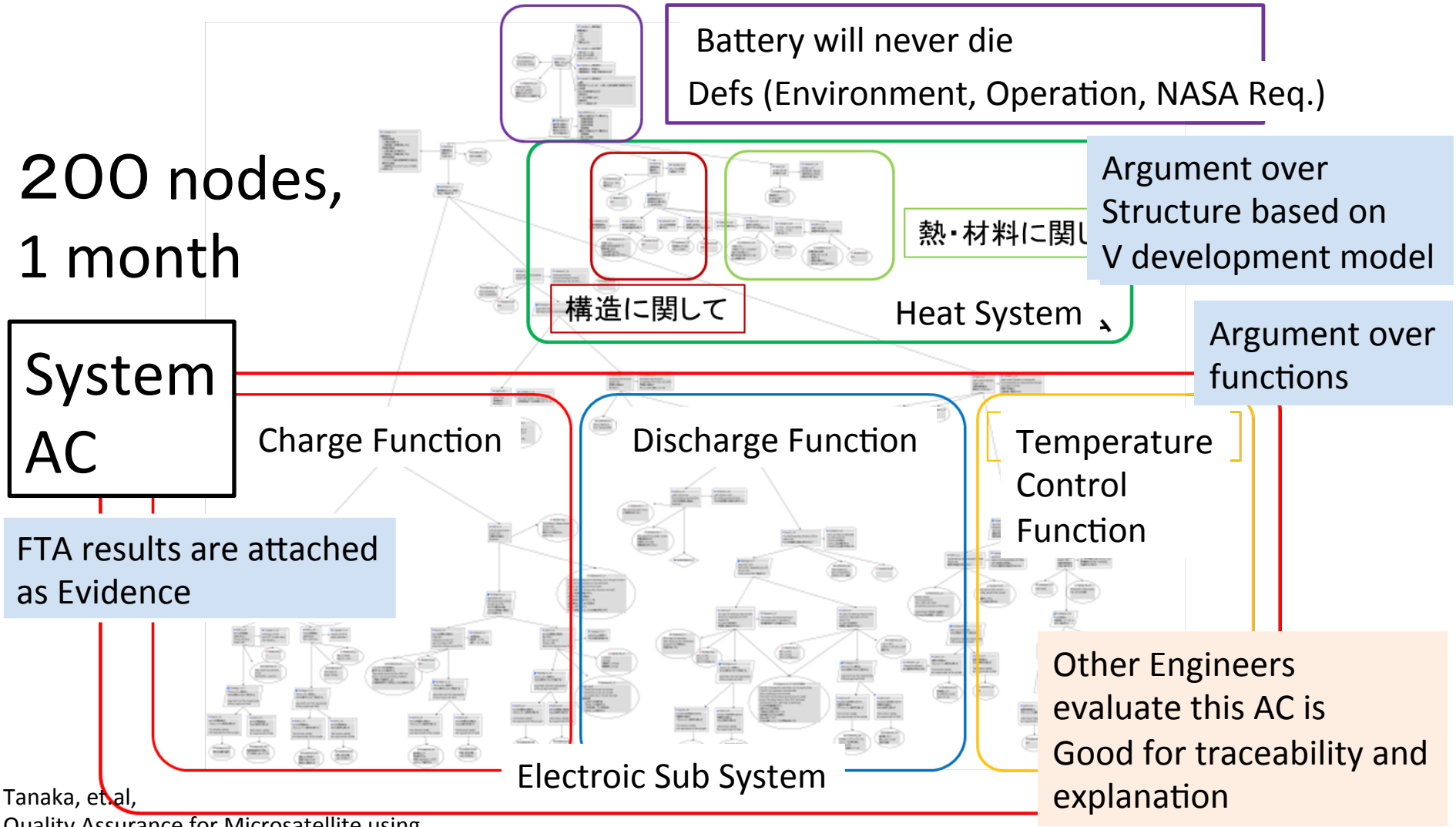
AC 2: Micro Satellite AC (2013)

- “Battery will never die”
- The developer (MS student) himself wrote AC according to the V model development process



http://park.itc.u-tokyo.ac.jp/nsat/hodo2.html

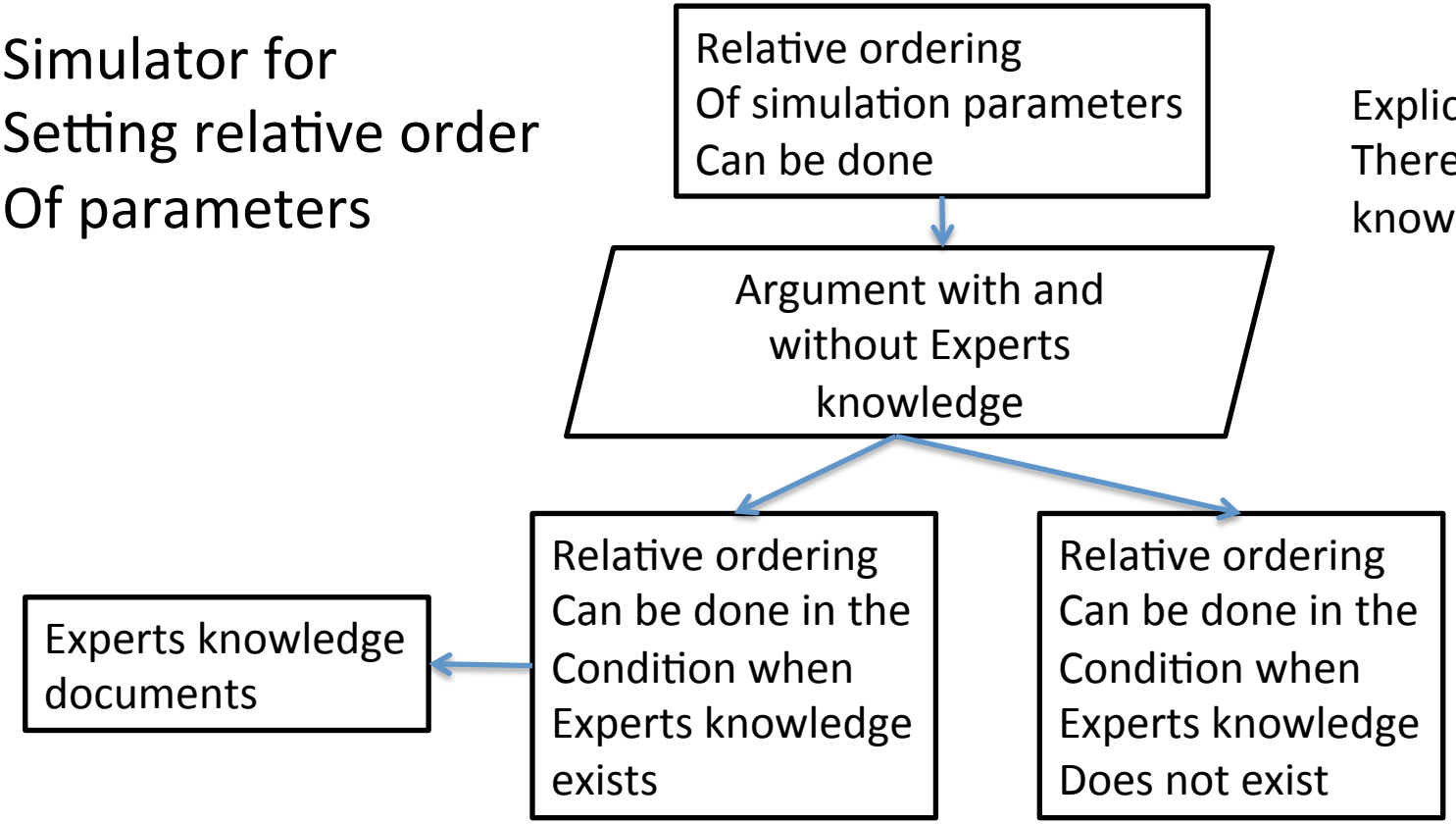
Micro Satellite AC



Tanaka, et.al,
Quality Assurance for Microsatellite using
Assurance Cases in Systems Engineering
Submitted for publicaiton, 2015

AC 3: for Mitsubishi Simulator (2014)

Simulator for
Setting relative order
Of parameters



Explicitly show that
There are experts
knowledge

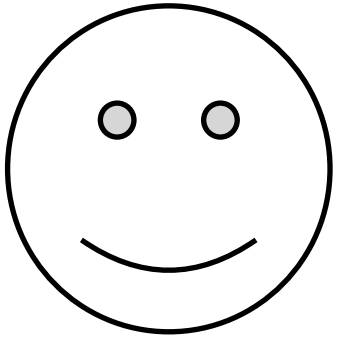
https://www.ipa.go.jp/files/000046465.pdf

Simple Observation

- System AC
  - General Goal: System is safe, secure, …
  - Typical Arguments (Argument over sub systems,…)
  - FTA, FMEA results as contexts and evidence
    Huge Cost -> Automation and Verification Needed
- Situational AC
  - Specific Goal: “Relative Ordering of Simulation Parameters can be done”
  - Situation Dependent Arguments, 20~ nodes
    Low Cost

Situational AC

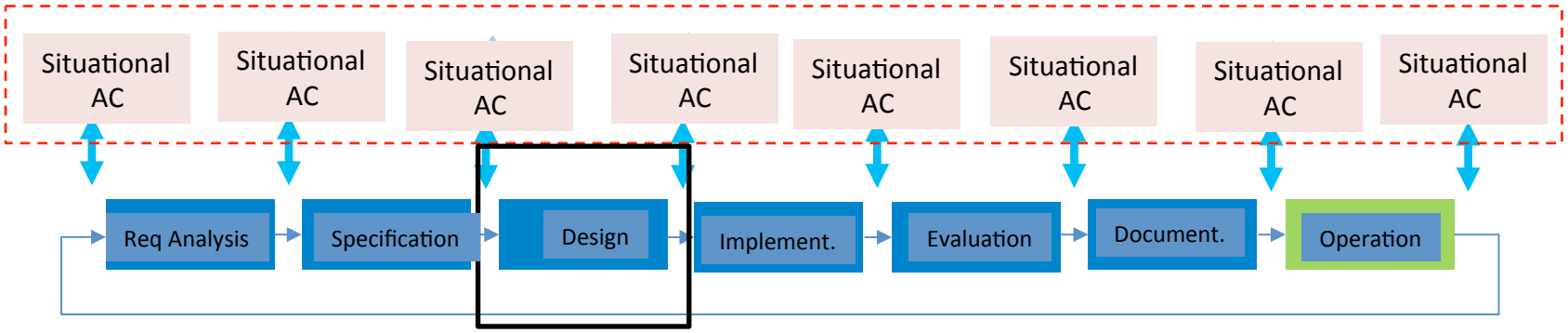
Mitsubishi Case



Designer

Relative Ordering of Simulation parameters Can be done

Expert



Answers for AC challenges?

- When, who write and evaluate?
  - In a situation, by Stakeholders in which assumption, culture may be different
  - Ex. Automotive and Supplier Companies in design phase
- Goal, Argument Structure
  - Specific (not necessarily directly related to safety, security, …) and understandable for all stakeholders
- Granularity, Size
  - At most 20 nodes (in GSN), within a Power Point slide

Tool (DSN 2014 paper)

- Design and Implement GSN tool (D-Case Editor, www.dcase.jp)
  - Formalize GSN community Standard using Functional Programming Language Techniques
  - Pattern (parameter, loop, choice, multiplicity) and Module System

  Design and implementation, and then verification

Concluding Remarks

- Dependability is Consensus Building
  - Assurance Case is a method for that
- System AC (huge cost, automation and verification required) and Situational AC (lightweight, practical)

Concluding Remarks

- DEOS Consortium
  - www.deos.or.jp
- D-Case Working Group
  - www.dcase.jp
  - Started writing Situational AC with Japanese Automotive companies
- D-Case Certification Scheme started in 2015.6
  - D-Case Syntax (Based on DSN2014 paper) Astah/GSN Certified!
  - D-Case Syllabus Denso Create Certified!

D-Case Project Logo