47th SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES (D5)
Ensuring quality and safety in a cost constrained environment: which trade-off? (1)

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A VISUAL APPROACH TOWARDS HIGH LEVEL REQUIREMENT (HLR) TO BLACK BOX TEST COVERAGE AUTOMATION FOR MISSION CRITICAL SOFTWARE ASSURANCE

Abstract

ISAC is the lead centre of the Indian Space Research Organisation (ISRO) in the development and operationalisation of satellites for communication, remote sensing, navigation, interplanetary and science missions. In all these spacecrafts, highly advanced embedded systems, carry out a variety of mission critical functions. These systems are extremely complex in logics due to features like on-board autonomy, Fault Detection Isolation and Recovery, control systems, data acquisition, security, safety etc. ISROs endeavours specifically interplanetary, science and human space programmes placed backbreaking challenges to SQA engineers. In MARS Orbiter Mission (MOM), for example in Attitude and Orbit Control Electronics (AOCE) subsystem, the on-board brain, new autonomy features and sequencer logics are equally or more complex than any communication and remote sensing missions in requirement complexity, test cases generated and code footprint. Apart from the mission specific requirements, MOM's rate of requirement evolution and modification with respect to fixed target date of delivery posed serious challenge to software QA community towards carrying Impact Analysis and Regression Testing. As per the existing practices, on-board software assurance pertaining to HLR traceability and test coverage is carried out manually in a person dependent approach. Checklists and guidelines are used to minimize person dependent factors for qualifying the product. In this scenario, automatic traceability of HLR and test case adequacy to meet 100% requirement coverage became desideratum to SQA engineers. From various proposed methodologies, considering the pitfalls, a generalized image based, meta language supported technique is evolved in SDLC (Software Development Life Cycle) automation tool ecosystem. For image representation, first priority was UML (Unified Modelling Language), due to its uniqueness in grammar. But the non object oriented way of visualization and procedural nature of programming created the hurdle for having UML as a unanimous choice. Here an innovative way of TIV (Text Image Verify) meta script is developed to bridge the gap between established images (UML, Legacy, hand drawn), text and finally test cases and coverage. TIV concept is based on the fact that "requirements are testable". TIV is used through out the SDLC in various phases to translate understanding of engineers into domain specific representations in V model. This will give the confidence to customer right on the developed blueprint than on any derived documents

or databases. TIV designed for on-board satellite software V&V activities can be adapted to software of any kind. This paper explains "requirements are testable" concept, TIV script, platform for automatic TIV generation and case study of MOM AOCE subsystem.