

# Promising results from the customization of the Commanding and Monitoring Frameworks of INPE Satellite Control

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The Commanding and Monitoring frameworks are two fundamental stones of the SATellite Control System (SATCS) architecture at the National Institute for Space Research (INPE). They consist of a set of integrated classes which provide a pre-defined base infrastructure to support the development of applications for the remote control and monitoring domains. Those domains include controlling and monitoring functions from both satellites and ground stations. These frameworks permit creating applications that could achieve highly software reuse and a low cost on development. In order to reach these targets, the following concepts have been widely used in the design: design-patterns, component-base development, and metadata. Recently, some software products have been created using the two frameworks and the promising results of their developing processes show that the objectives of maximizing reuse and decreasing costs have been succeed. In a short time and using a small group of people two software applications have been developed for the team that was testing the engineering model of the fourth China Brazil Earth Research Satellite (CBERS3): TMTCAIT (kernel functions for telecommand and telemetry processing) and CBERS3AOCSTC (decoding of AOCs telecommand binary files). The application DSSCOP1CTX to study the use of the CCSDS COP1 protocol for sending telecommands through the CORTEX baseband equipment has also been created. The use of the frameworks and metadata were not the only reasons, taking into account the small staff and short deadlines, for the success in implementing these products. The reuse of the testing infrastructure of the frameworks and its validation process were also decisive. They have been created to validate the frameworks and had an important role in decreasing the effort for validating these three products and proved to be another important dimension of reuse.

## I. Introduction

THE Commanding and Monitoring object oriented frameworks were developed based on the architectural templates and design solutions proposed by SATellite Control System (SATCS)<sup>1</sup>. They are a set of integrated classes that provides a pre-defined base infrastructure to support the development of applications for the remote control and monitoring domains. Those domains include control and monitoring functions of both satellites and ground stations.

The design of these frameworks took into account the common and variable requirements that can occur among different missions in order to make it easier to create the monitoring & control applications required for each specific mission. Using design patterns brings flexibility to change the code to comply with new requirements, since the code is designed to accept changes, thus saving time and reducing future developments costs. Breaking down the frameworks in modules makes it easier to change a specific part of the problem domains because the change would be concentrated in a specific module. By using metadata is possible to reduce drastically, or, in some cases, even to eliminate the need to adapt the application codes to comply with new requirements. These frameworks allow creating applications that could achieve highly software reuse and a low cost on development. To reach these

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