



Efficient Data Generation and Publication as a Test Tool

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A tool to facilitate the generation and publication of test data was created to test the individual components of a command and control system designed to launch spacecraft. Specifically, this tool was built to ensure messages are properly passed between system components. The tool can also be used to test whether the appropriate groups have access (read/write privileges) to the correct messages. The messages passed between system components take the form of unique identifiers with associated values. These identifiers are alphanumeric strings that identify the type of message and the additional parameters that are contained within the message. The values that are passed with the message depend on the identifier. The data generation tool allows for the efficient creation and publication of these messages. A configuration file can be used to set the parameters of the tool and also specify which messages to pass.

I. Introduction

In a large scale system such as the ones found in command and control systems to launch space crafts, efficient communication between components of the system is invaluable. Users of the system need access to the appropriate hardware resources and need to be able to receive data from those resources as fluidly as possible. Correspondingly, those hardware resources need to be able to publish data correctly and in the proper format. With the number of users and the number of system components that the spacecraft launching systems contain, testing whether each entity can properly send and receive messages becomes a daunting task.

To accomplish this task, a program was created which allows different entities to create and publish multiple messages. Users of this program are provided an interface with which to initialize parameters such as which system component needs to be simulated, which messages should be passed, and how long of a delay should be implemented between the publication of each message. This could be used to effectively simulate the desired functionality of the system component during the actual runtime of the system. It could also be used to test the limits of message passing (testing edge cases of values in messages), ensure that every message to which a group should have access can be accessed, and test the speed of message passing, as well as a variety of other cases. With proper testing of the space launching systems, claims can be made about the safety and reliability of the system. As the complexity of the missions that the launching system facilitates increases, the claims about the safety and reliability of the system become increasingly important.

The new command and control system currently in development will launch a new rocket design. This rocket will carry spacecrafts which will go on to a variety of destinations ranging from Earth orbit, to destinations beyond the Moon, such as Mars. A unique aspect of the new rocket is that it is modular, allowing for several different configurations. When each of these configurations will be used depends on the payload and the objectives of the mission. Because of the modular nature of the rocket, and the range of tasks the rocket will be required to perform, adequate testing of all these different system components is imperative. As humans will also be launched using the new rocket, strict safety guarantees will need to be ensured. The created data generation and publishing tool provides an efficient method to aid in the realization of these guarantees.

II. Design

The data generation and publishing tool was designed to be used by individual users wishing to test some aspect of the command and control system. Each of these users could potentially require a different functionality from the tool. Users will be able to interface with the tool through a configuration file which will initialize

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parameters. From a high level, these parameters specify who is publishing and what they would like to publish. The configuration file also allows users to specify how they would like messages to be published, if there should be a delay in the message passing, and if the values of the messages should change during runtime. Once the configuration file has been created, the user can run the data generation program with the configuration file as an input.

When the program launches, it will parse the configuration file and initialize any interactions the program will have with the command and control system. The configuration file will provide specific messages that the data generator will then go onto publish. The configuration file can also be used to specify that all the messages that a certain system component is able to access should be published. Users can also specify whether these messages will have manually entered values, or default values that the program will provide. These messages are stored in a list, with each message being stored in a common format. Although there are several types of messages that the system uses for communication, the common format allows the user to add and remove different types of messages without any additional effort.

Upon the completion of the list creation, message publication can start. The program cycles through the message list and publishes each message with a predetermined delay between each publication. This delay is crucial in simulating true system behavior as messages will seldom be published one after the other with no delay. During publication, the values of a particular message can be altered and the same message can be published again if users have specified that option. This allows for intra-message testing as well as providing additional functionality to the program.

During the publication, statistics are kept about the performance of the publisher. The number of successful publications, the messages that were not able to be published, and the time it took for the program to run are all measured during the runtime of the tool. These statistics can provide a metric for the performance of the system components. When all the messages have been published, the statistics are presented to the user and the program terminates.

III. Analysis

The data generation tool provides a clean, simple interface for users to test the communications of system components. It allows for multi-scale message generation and publication. This means that users are not only able to publish a small number of specific messages with specific values, but also they are able to publish a vast number of messages with wide ranges of values. This flexibility allows for the data generation tool to thoroughly test the system.

The statistics generation is also a useful tool that can be used to fix and identify issues with system components. Because the statistics provides a list of messages that were unable to be published, and because the messages are linked to specific functionality, the debugging of the system component can be simplified. Without an indication of which messages are causing problems, the debugging of the system component would be a very inefficient process, as the internals of the component would have to be tested separately to locate which specific section has an issue.

IV. Conclusion

Creating efficient and thorough methods for testing a system is invaluable. These tests allow guarantees to be made about the functionality of the system. As a system grows, so must the amount of testing to ensure proper functionality and to verify that the guarantees that were created for previous tests still hold for the system given the larger scale. With an increase in testing, comes an increase of the temporal aspects of testing. Therefore, the creation of a generic tool that can be used to test multiple aspects of a system becomes increasingly important as that system grows to reduce the overall time it takes to test. The data generation program is a tool that can be used in this generic manner. With the ability to generate and publish a variable number of messages from any system component, each with a wide range of values, the data generation tool can be used with all aspects of a command and control system. The performance of the tool, indicated by the generated statistics, can then be used as a measure of the performance of the certain system component. Thus, when used on all system components, the tool can provide a measure of the performance of command and control systems themselves. With this tool, a better space launch system can be created for mankind to realise its future amongst the stars.

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VI. References

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