The O^{3}neida Publications Series

This book is one of a series of books to be produced within O^{3}neida on various subjects related to distributed automation.

O^{3}neida is a Canadian not-for-profit corporation. O^{3}neida Europe is a not-for-profit association headquartered in Brussels, Belgium. Together they form the hub of the O^{3}neida networks. Their joint mission is to operate as a network of networks fostering the development and deployment of distributed industrial automation technologies based on open standards.

These standards include, among others, the Foundation for Intelligent Physical Agents (FIPA), the Device Profile for Web Services (DPWS), Web Crawler (WC), and International Electrotechnical Commission (IEC) 61131 and 61499.

This book is addressed to technical university students and researchers who wish to understand network systems in industrial automation and their features related to real-time and functional safety requirements.

The book begins with the introduction of the basics of standard Ethernet, specifying the Open System Interconnection (OSI) reference model layers and identifying Ethernet's drawbacks. This discussion will clarify the requirements and the solutions adopted by the communication protocols presented later in the book.

Second, "real-time capability" is defined with specific regard to communication within safety-related systems, underlying the strict correlation between time performance and external requirements.

Finally, the specifications of the safety profiles of five communication protocols (namely PROFIsafe, Ethernet Powerlink Safety, SERCOS

III Safety, EtherCAT Safety and Ethernet/IP Safety) are investigated. The technical characteristics of each communication protocol are considered, and the measures adopted to detect errors and keep the residual error probability under a certain limit are also analyzed.

Future volumes in the O^3neida/ISA series will address other equally pressing issues such as case studies of IEC 61499 implementation, supporting real-time execution in industrial automation applications, and Ontologies. O^3neida will also provide a compendium of selected papers from the 50th ANIPLA Conference.

O^3neida will also produce materials on automation objects as part of this series.

Finally, this book is the result of a concerted effort by many O^3neida members. I thank them all for their dedication and commitment to O^3neida as volunteers. I particularly thank Luca Ferrarini, Alberto Elia, and Carlo Veber of the Politecnico di Milano, Italy for leading this effort and also Allan Martel, O^3neida Chief Operating Officer, for coordinating and managing the development of the O^3neida series of books on distributed automation.

I also thank ISA for their interest and support in making the publication and distribution of this important book possible.

—Antonio Valentini
Chief Executive Officer
O^3neida