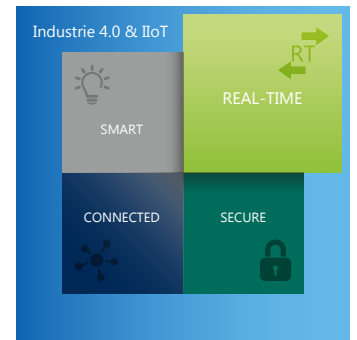


Real-Time Test Framework

Release 02.09.20



Scope

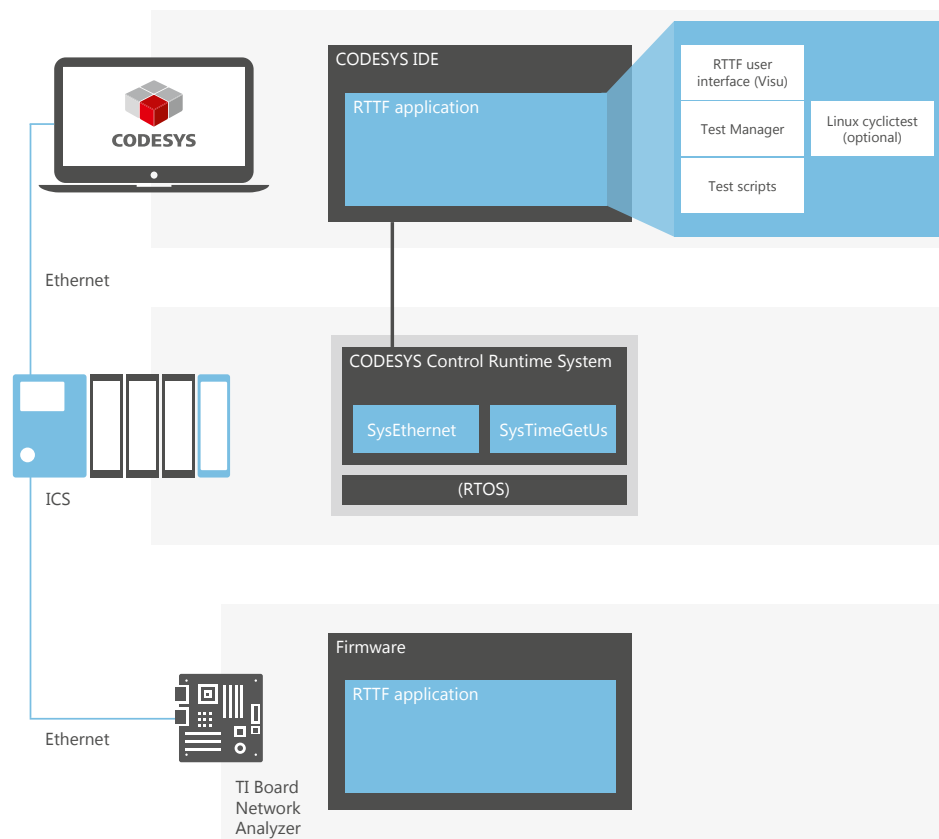
Due to the improvement of processing power, modern Industrial Control Systems (ICS) tend to offer more built-in functionality to manage a larger range of applications. Other factors like the communication speed of field bus protocols require the ICS to perform in a very deterministic manner. Depending on the firmware architecture, the Operating System, application software tools, communication stacks and the implementation/development of the firmware, the real-time performance of the ICS is influenced. In case of insufficient determinism behavior of the system, it is difficult to trace the cause for such performance without specific tools.

Functionality

- The Real-Time Test Framework is a set of software and hardware modules allowing testing of the real-time performance of a CODESYS based ICS
- The Real-Time Test Framework tests real-time performance of the ICS (task jitter) and the communication on the Ethernet interface (Ethernet frame transmission jitter and roundtrip time)
- The application is a CODESYS project including visualization and automatic tests
- The user interface is a CODESYS Visualization project providing settings and results
- Tests are executed automatically using the CODESYS Test Manager
- The I/O system is replaced by a jitter-free board that acts as network analyzer
- Open source tests "Cyclictest" for Linux platforms is embedded

Target Applications

- Companion tool during the development phase of a new ICS
- Benchmarking of ICS
- Test real-time performance under critical or custom specific use cases, not easily reproducible with hardware components or environmental conditions
- Debugging firmware in case of insufficient real-time performance
- Quality assurance process



Hardware and software architecture of the RTTF

Features and benefits

User friendly interface

The complete user application is a single CODESYS project using visualization and Test Manager (not part of the delivery) ⇒ comprehensive single user interface and test report

Cost saving through reduced test bench material

The Network Analyzer board replaces expensive I/O systems ⇒ provides more precise measurement (eliminating jitter produced by the I/O system)

Customization of test conditions

The use cases are provided in form of test scripts and can be extended by the user ⇒ customer specific conditions can be tested

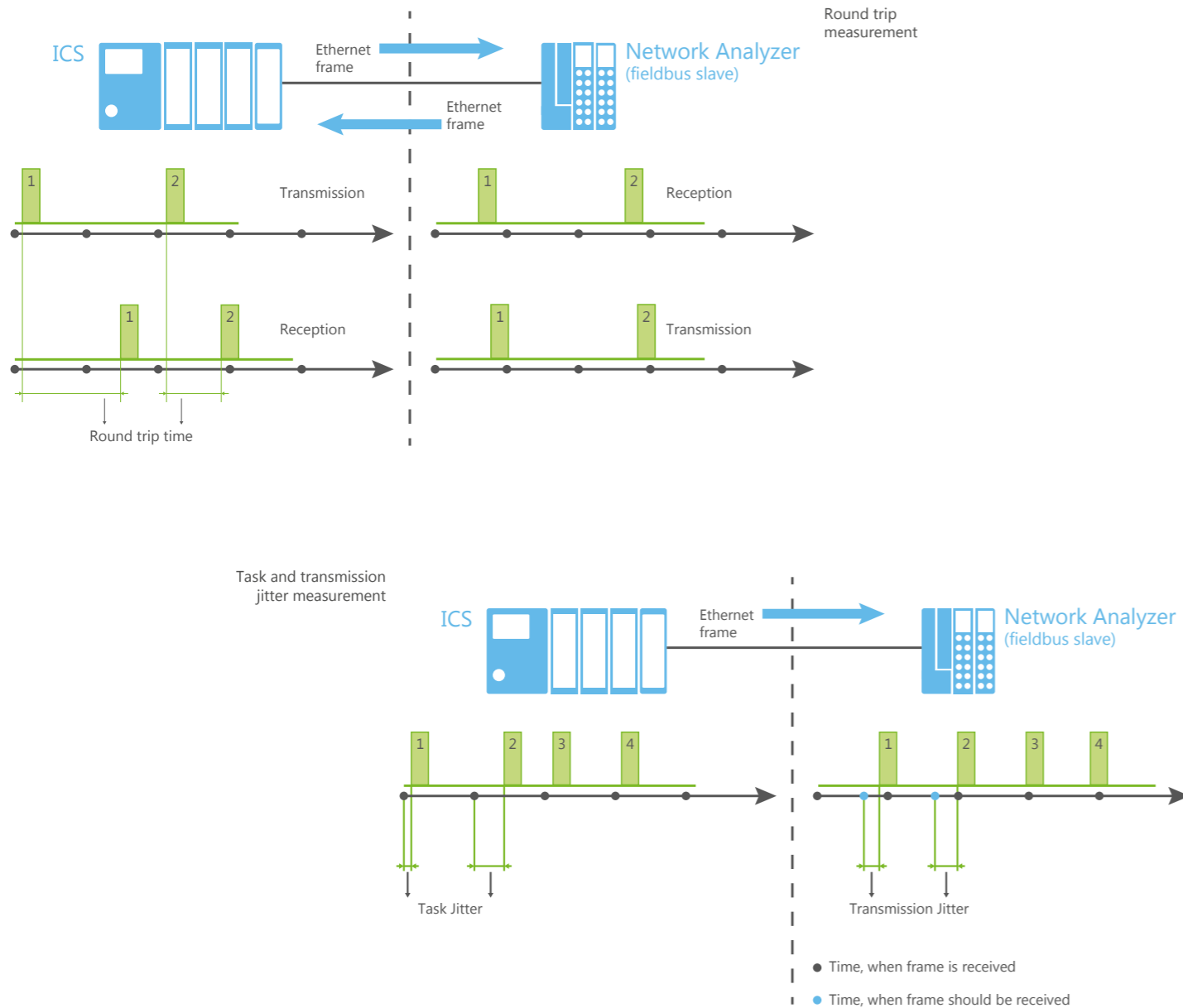
Optimized debugging capabilities

Tests can be run automatically after each firmware development phase ⇒ simplifies the investigation process in case of loss of performance

Extendable Framework

BE.services can extend the content of the tool ⇒ additional customer specific features and brand labelling can be implemented

Mechanism



Delivery includes

- Hardware:
 - TI-AM3359ICE2 (network analyzer)
 - CODESYS Security Key (management of licenses i.e. CODESYS Test Manager)
- Software:
 - RTTF CODESYS project including user interface
 - Test scripts
 - RTTF application firmware for the network analyzer
 - CODESYS ControlWin SL license (necessary for performance tests under network variable exchange test condition)

Screenshots

The screenshots show the BE.services user interface. The top part displays 'Ethernet adapter settings' and 'Test parameters' including cycle time, jitter limit, and test status. Below are two bar charts: 'Task jitter' and 'Transmission jitter'. The task jitter chart shows a maximum value of 95us, and the transmission jitter chart shows a maximum value of 157us. A legend indicates that green bars represent successful tests and red bars represent failed tests.

Annotations point to specific UI elements:

- 'Choose the Ethernet interface for the test' points to the Ethernet adapter settings.
- 'Set parameters including jitter limit' points to the test parameters section.
- 'Results for task jitter' points to the task jitter bar chart.
- 'Result value of maximum jitter with color indication' points to the 95us value in the task jitter chart.
- 'Status of the test process' points to the test status section.
- 'Result for transmission jitter' points to the transmission jitter bar chart.
- 'Result value of maximum jitter with color indication' points to the 157us value in the transmission jitter chart.

The screenshot shows a test report from BE.services. It includes a summary of test results:

- Total test cases: 42
- Succeeded: 31
- Failed: 11
- Skipped: 0
- Execution time: 00:14:28

 The report details the execution of various actions, such as 'Prepare project', 'DownloadAndRun', 'SetActiveApp', 'Login', 'Reset', 'Run', 'StartTheTest', 'OpenVisu', 'WaitForTestResults', 'CompareSendJitter', 'CompareReceiveJitter', and 'CompareRecJitter'. Some actions are marked as 'Failed' in red.

Test report

Engagement model

How to get?

Product	Manufacturer	Part Number	Sales Contact
BE. Real-Time Test Framework	BE.services GmbH www.be-services.com	0230001	info@be-services.com
Development services (Extensions)	BE.services GmbH www.be-services.com	0220005	info@be-services.com



Technical data

User Interface PC		ICS	
Windows version	See versions supported by CODESYS IDE	OS	Any OS supported by CODESYS Control Runtime System
CODESYS IDE	From V3.4	CODESYS Control	From V3.4, implementing SysEthernet

Targeted fieldbus protocols and stacks:

Protocol stack	3S/CODESYS	Third-party
EtherCAT	X	On demand
Ethernet IP	X	On demand
Profinet	X	On demand
Powerlink	N/A	On demand

Featured Manufacturers



Support

Please contact info@be-services.com

www.be-services.com