



# Release Presentation

## **ASAM Common MDF Version 4.1.0**

Measurement Data Format

Release Date: 2012 / 11 / 20

# Agenda

- ▶ Introduction
  - Key Concepts
  - History
- ▶ ASAM Working Group
- ▶ Deliverables
- ▶ What's new in MDF 4.1.0
  - Base Standard and new Associated Standards
- ▶ Compatibility
- ▶ Compliance to other ASAM Standards
- ▶ Summary
  - Benefits

# Introduction

## Overview

- ▶ MDF (Measurement Data Format) is a binary file format to store measured or calculated data for post-measurement processing or long-term conservation.
- ▶ Common sources of the data to be stored are sensors, ECUs or bus monitoring systems.
- ▶ With MDF a high performance can be achieved for both writing and reading signal data.
- ▶ In addition to the plain measurement data, MDF also contains descriptive and customizable meta data within the same file.

# Introduction

## Key Concepts

- ▶ Compact binary format organized in loosely coupled blocks
- ▶ Measurement data stored in records according to sample rate
- ▶ Record layout and general signal description given by channels
- ▶ Supports multiple and non-periodic sample rates
- ▶ Synchronization via master channel concept
- ▶ Special data types and meta information used in automotive area
- ▶ Data received (e.g. from ECU) can be stored "as is"
- ▶ Conversion rules for calculation of physical values from stored raw values
- ▶ Extension of meta information by XML or "attachments" (embedding or linking of other files)

# Introduction

## History

- ▶ 1990: MDF designed for use in the automotive industry
- ▶ 1991 until today: MDF versions 2.x and 3.x have successfully been used over many years and evolved to a de facto standard
- ▶ 2009: release of ASAM Common MDF 4.0.0 as result of a major update of the format and standardization by ASAM e.V.
- ▶ 2009-2102: ASAM working group for maintenance and future version development incorporates feedback and new ideas from MDF users.
- ▶ 2012: release of ASAM Common MDF 4.1.0 including three new associated standards

# MDF 4.1.0 Future Version Development

## Working Group Members

- ▶ **BMW AG**
  - Ralf Kemle
- ▶ **dSPACE GmbH**
  - Thilo Maeck
  - Markus Unland
- ▶ **ETAS GmbH**
  - Tobias Langner
- ▶ **Porsche AG**
  - Michael Jörger
- ▶ **Vector Informatik GmbH**
  - Herwin Grauel
  - Otmar Schneider

# Deliverables

Released with ASAM MDF 4.1.0

- ▶ **ASAM Common MDF Programmers Guide (Base Standard)**
  - Version 4.1.0
  - includes XML Schema files and MDF example files
- ▶ **Associated Standard "Naming of Channels and Channel Groups"**
  - Version 1.0.0
- ▶ **Associated Standard "Bus Logging"**
  - Version 1.0.0
- ▶ **Associated Standard "Measurement Environment"**
  - Version 1.0.0

# What's New?

## Base Standard

### ▶ Maintenance

- Minor bug fixes and clarifications
- Foreword added

### ▶ New Features

- Compression of data blocks using two new block types
- New channel type for virtual data (e.g. for signals with constant value)
- New channel type for efficient storage of bus messages (variable but restricted length)
- Channel can refer to a number of attachments
- Channel can refer to some other channel to be preferably used as X axis
- New channel flag to indicate monotonously increasing/decreasing values
- New flags for channels and channel group for bus logging use case
- Storage of classification results and interval axes using existing array block
- Definition of a path separator character for names of channels and channel groups
- New XML tags to model lists in "common properties" section of meta data block



# What's New?

## Associated Standards

- ▶ **Naming of Channels and Channel Groups**
  - Naming convention for channels and channel groups for different use cases
  - Ensures unique identification of a channel
  - Shows how to store common information about a channel and its source/acquisition
  - Harmonization across the different tools

# What's New?

## Associated Standards

### ▶ Bus Logging

- Application model to store the traffic of common bus systems in MDF
- Currently for CAN, LIN, FlexRay, MOST and Ethernet
- Complete bus traffic of several bus systems can be stored in one MDF file
- Can be used both for replay and analysis of the bus events
- MDF file can contain both bus events and transported signals
- With some exceptions, signal descriptions can be added without duplication of data
- Application model is based on existing MDF structures and naming rules
- Information of bus events can be extended by custom members

### ▶ Compliance to ASAM ODS

- Next ODS Version 5.3 copies the application model for bus logging from MDF

# What's New?

## Associated Standards

### ▶ Measurement Environment

- Application model to store information about the measurement environment based on using generic XML tags in "common properties" section
- This additional information can be used to reproduce the measurement as well as for identification of measurement files produced by certain environment conditions (e.g. faulty equipment)
- Definition of only a small number of base attributes
- Designed for extension with customized information

# Compatibility

- ▶ **ASAM MDF 4.1.0 is an extension of ASAM MDF 4.0.0**
  - Backward compatibility: every valid MDF 4.0 file is also a valid MDF 4.1 file
  - Forward compatibility: old tools that only support MDF 4.0 should be able to read MDF 4.1 files while ignoring the new features
  
- ▶ **Associated Standards use the abilities of MDF 4.1.0 Base Standard**
  - Files created with one of the Associated Standards are valid MDF 4.1 files

# Compliance to other ASAM Standards

- ▶ **ASAM General Expression Syntax (GES)**
  - Used for conversion rules and trigger conditions
- ▶ **ASAM Harmonized Objects (HO)**
  - Used for units
- ▶ **ASAM MCD-2 MC (ASAP2)**
  - Storage of properties defined in ASAP2
- ▶ **ASAM ODS**
  - Apart from some exceptions ODS is able to use MDF 4.x files as external components
  - ODS 5.3 re-uses MDF application model for bus logging
  - Further exchange with ODS regarding additional information for classification results (new Associated Standard in preparation)
- ▶ **ASAM HIL**
  - Uses MDF for capturing measurement data

# Summary

## Benefits of ASAM MDF in General

- ▶ **Compact storage of measurement data in binary format**
  - Capable to store huge amount of measurement data (file size practically not limited)
  - MDF 4.1.0 introduces optional compression of the measurement data
- ▶ **High performance for writing and reading**
  - Data received from ECU can be stored without processing
  - Easy writing by simply appending the records produces "unsorted" MDF files
  - Loss-less re-organization of file ("sorting") to allow fast index-based access to samples
  - Distributed data blocks introduced in MDF 4.0.0 allow direct writing of sorted MDF files
- ▶ **Description of measurement data within the same file**
  - Important information in compact binary blocks, optional information in XML
- ▶ **Storage of customized meta information**
  - Generic XML tags allow easy display of custom information even by other tools

# Summary

## Benefits of ASAM MDF for Automotive

- ▶ **Specialized for use cases and requirements in Automotive area**
  - Logging of ECU data and bus traffic
  - Specialized data types and structures
  - Compliance to other ASAM standards
- ▶ **MDF 4.x continues success of well-established MDF 3.x**
  - Support by tools continuously increases
  - Major OEMs plan to establish MDF 4.x as company standard

# Summary

## Benefits of ASAM MDF 4.1.0

- ▶ **Backward and forward compatibility to ASAM MDF 4.0.0**
- ▶ **Compression of data blocks**
  - Reduction of file size (in some cases better than zipping the complete file)
  - Simplifies data logger use case (reduced memory)
- ▶ **Standardized storage of bus events and signal data within same file**
  - Allows analysis and replay of bus traffic
  - Bus events can be evaluated even without knowledge of AS "Bus Logging"
  - Easy extensibility with own bus information
- ▶ **Standardized naming of channels and channel groups**
  - Easier exchange between different tools
- ▶ **Storing additional information about measurement environment**
  - Allows reproduction of measurement (fulfillment of ISO 26262 Functional Safety)
  - Can be displayed by tools without knowledge of AS "Measurement Environment"