

Diagnosis

UDS Diagnosis

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- UDS
 - Basics
 - Communication
 - Key features
 - Further information
 - ODX files
 - Difference between XCP and UDS

- What is UDS?
 - Diagnostic communication protocol in ECUs
 - Specified in ISO 14229-1
 - Successor of KWP2000 and ISO 15765-3
 - Used in almost all new automotive ECUs
 - Functionality for diagnostic purposes
[error storage, read/write data, routine control, programming]
 - Data transfer via CAN, Ethernet, LIN, K-Line, CXPI or FlexRay
 - Full featured diagnosis system

ISO – International Organization for Standardization

KWP2000 – Keyword Protocol 2000

UDS – Unified Diagnostic Services

- Main objectives
 - Standardized measurement, calibration and diagnosis tools
 - Vendor independent
 - One tester is able to diagnose complete system/vehicle
 - Protocol to ensure process safety
[e.g.:
safe update process (flashing) for vehicles in the field]

- Use cases
 - Reading measurement values
 - Reading/Writing datasets
 - Triggering ECU routines
 - Accessing error storage
 - Analysis during development
 - Setup during production
 - Flash programming
 - OBD (onboard diagnostics)

 - Used for single ECUs and complete systems [e.g. vehicles]
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- UDS is based on the master-slave principle
 - Tester tool is the master
 - Master can communicate with many slaves simultaneously ['functional addressing'] or with only one slave ['physical addressing']
 - ECU is the slave
 - Slave can only communicate with one master at a given time
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- UDS data is exchanged in a message-based way
 - UDS packet is embedded in a frame of the transport layer (e.g. ISO TP)
 - UDS message types:
 - Request without sub-function or Positive Response
 - Requests with sub-function byte
 - UUDT-Responses
 - Negative Responses
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- Request without sub-function or positive response



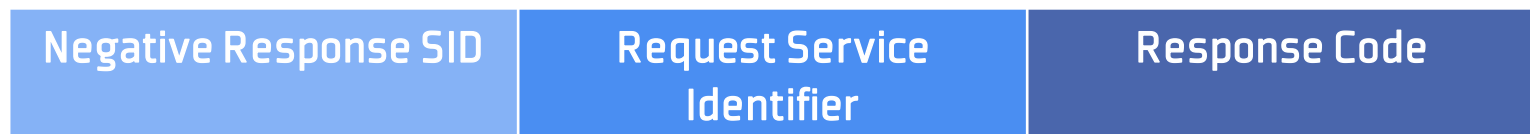
- Requests with sub-function byte



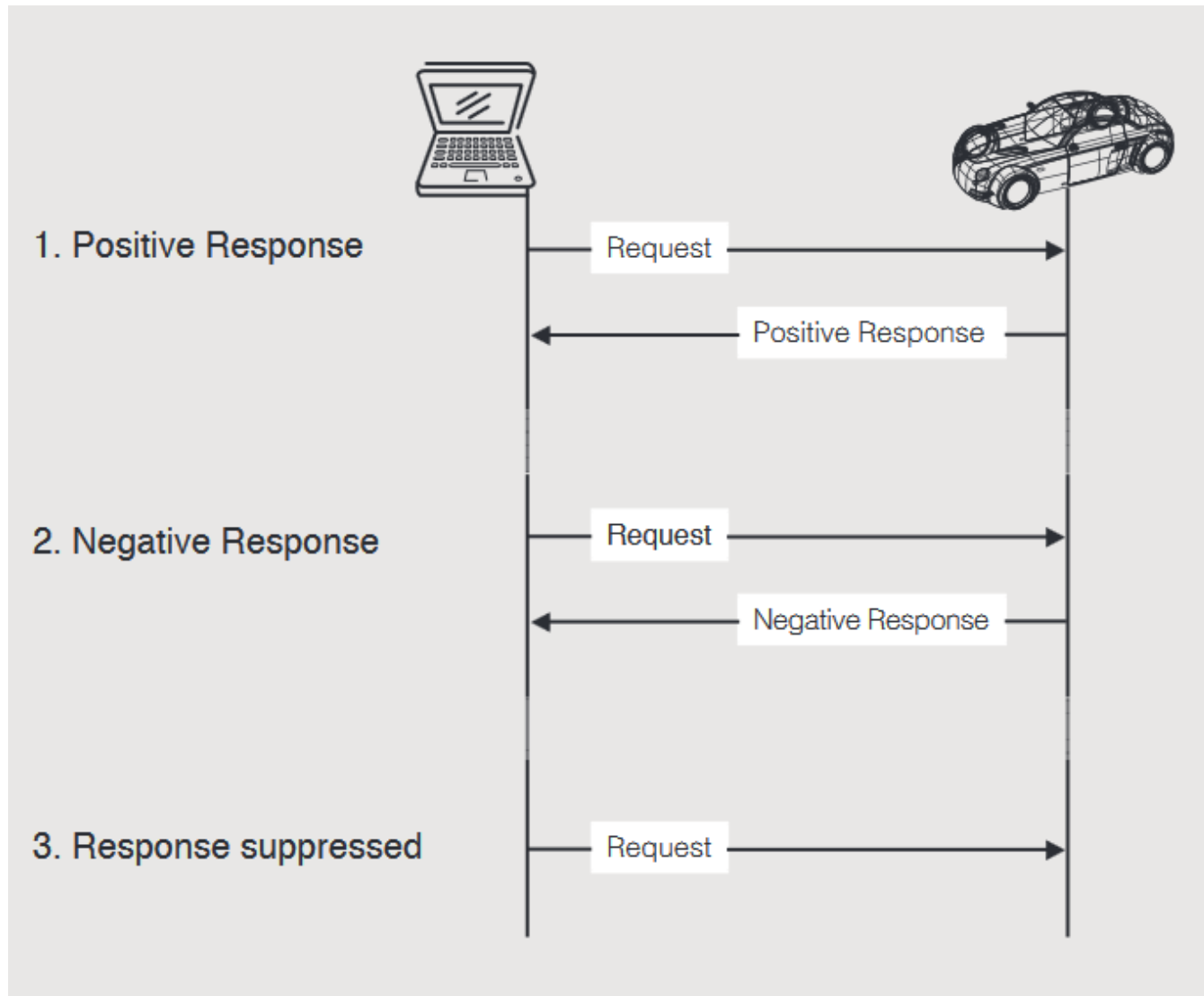
- UUDT responses



- Negative responses



UDS: Communication



UDS: Communication

Functional Unit	SID	Service Name
Diagnostic and Communication Management	0x10	Diagnostic Session Control
	0x11	ECU Reset
	0x27	Security Access
	0x28	Communication Control
	0x3E	Tester Present
	0x83	Access Timing Parameter
	0x84	Secured Data Transmission
	0x85	Control DTC Setting
	0x86	Response On Event
	0x87	Link Control

UDS: Communication

Functional Unit	SID	Service Name
Data Transmission	0x22	Read Data By Identifier
	0x23	Read Memory By Address
	0x24	Read Scaling Data By Identifier
	0x2A	Read Data By Periodic Identifier
	0x2C	Dynamically Define Data Identifier
	0x2E	Write Data By Identifier
Store Data Transmission	0x3D	Write Memory By Address
	0x14	Clear Diagnostic Information
	0x19	Read DTC Information

UDS: Communication

Functional Unit	SID	Service Name
Input Output Control	0x2F	Input Output Control By Identifier
Remote Activation of Routine	0x31	Routine Control
Upload Download	0x34	Request Download
	0x35	Request Upload
	0x36	Transfer Data
	0x37	Request Transfer Exit

- Session handling
 - Services can be divided into **session groups**
 - Session groups:
 - Can be mapped to system states (e.g. flash loader)
 - Can be mapped to user groups (e.g. production, customer etc.)
 - Security access
 - Secured diagnosis services can only be accessed with a security access
 - Different security accesses for different user groups or diagnosis sessions
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UDS: Key features

- Physical addressing – point to point communication
 - Tester communicates with one ECU
 - Positive response is usually send from ECU
 - Negative responses are always sent
- Functional addressing – point to multi point comm.
 - Tester communicates with several ECUs
 - Positive response is usually suppressed from ECU
 - Negative responses are always sent

UDS: Key features

- Access memory by address
- Access memory by identifier
[predefined data blocks]
- Response on event
[ECU sends data blocks on internal events]
- Error and event storage
[read/write/control DTCs and environment data]

UDS: Key features

- Routine controls
[start/stop/request status of predefined internal ECU functions]
- Process safe data upload and download
[e.g. for read/write flash or EEPROM data]
- Provides serial number handling
[e.g. part number, fingerprints]

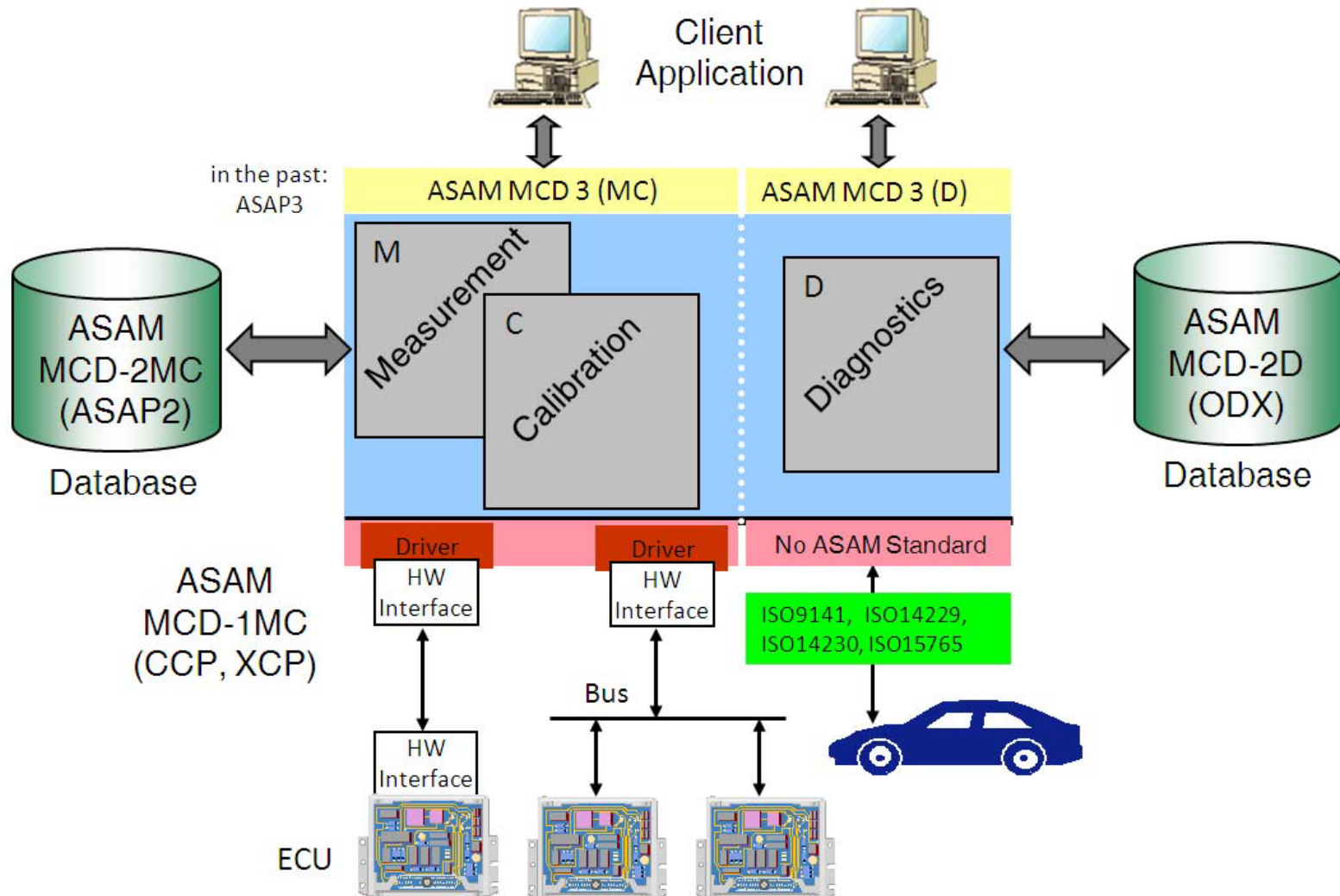
UDS: Further information

- A complete description of UDS can be found in the current version of the ISO 14229-1 and -3 specification:
<https://www.iso.org/standard/55283.html>
<https://www.iso.org/standard/55284.html>
 - For UDS on CAN additionally the ISO 15765-3 specification is interesting:
<https://www.iso.org/standard/33618.html>
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- Description Files for diagnosis services:
 - Describes an XML format for exchanging diagnostic data
 - Contains diagnostic specifics
 - Contains flash data for individual ECUs
 - Contains information on accessing the entire vehicle network

ODX – Open Diagnostic data eXchange

Difference between XCP and UDS



Difference between XCP and UDS

■ XCP

- Used
 - Development
 - Production
- Lean diagnostic
- Fast
- Less protocol overhead
- Reading/writing memory (by address)
- Flash programming
- Time stamping for measurement data

■ UDS

- Used
 - Development
 - Production
 - Field (Service)
- Full featured diagnostic
- Reliable
- More protocol overhead
- Reading/writing memory (by identifier)
- Flash programming
- Access to error storage
- Execute ECU routines

Thank you for your attention!
