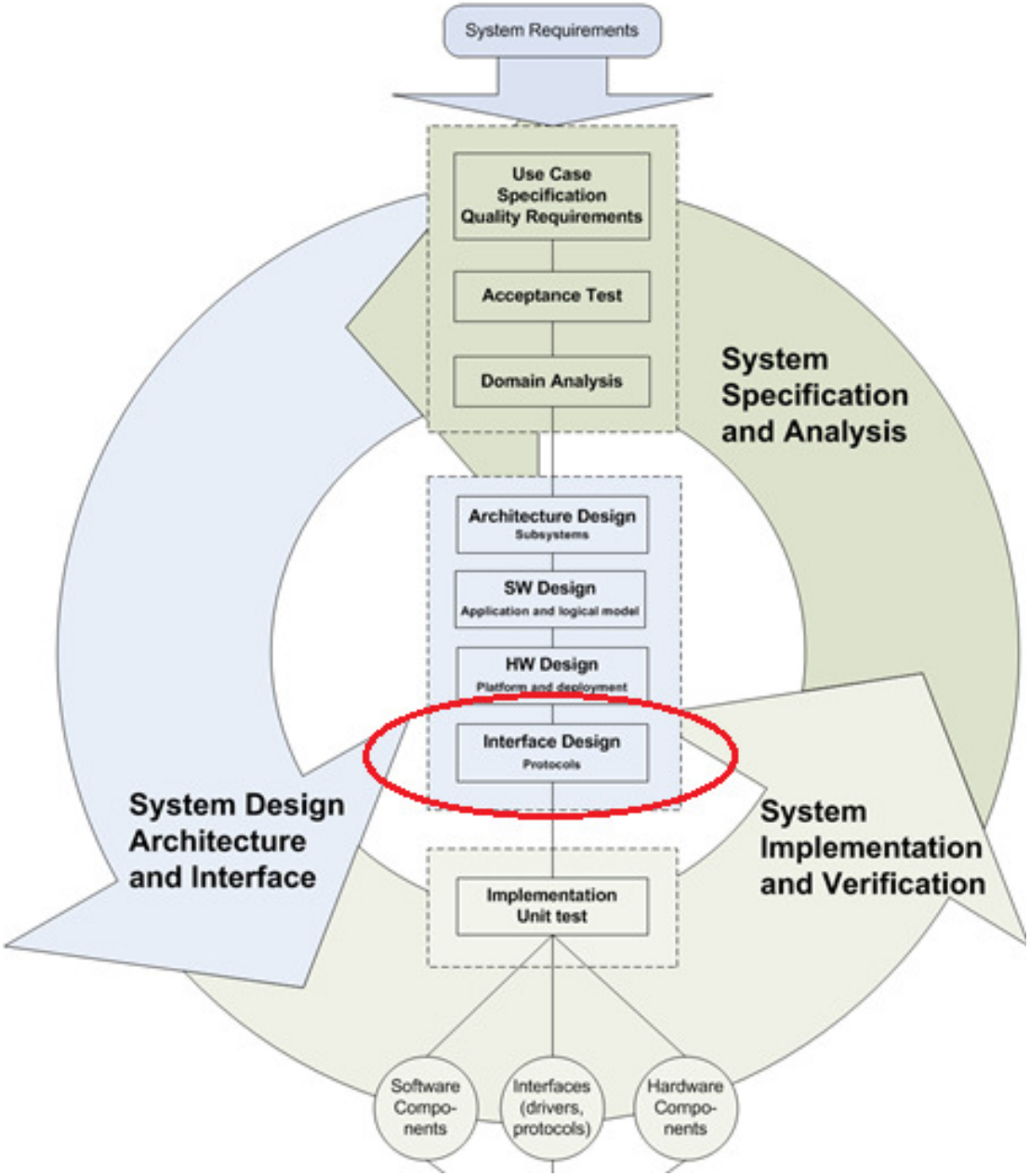
ISE

Grænseflader (Interfaces)

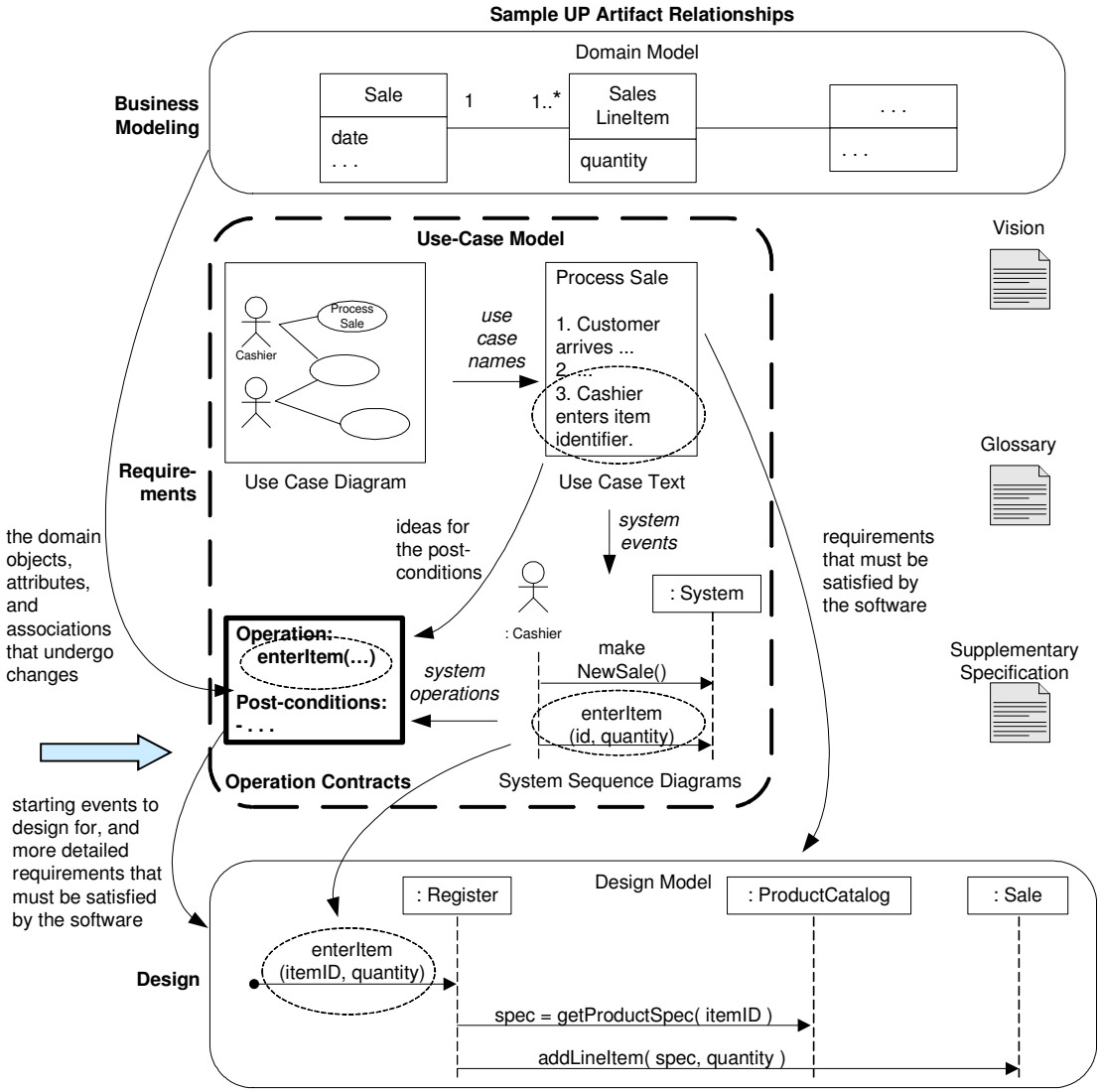
The System Engineering Process



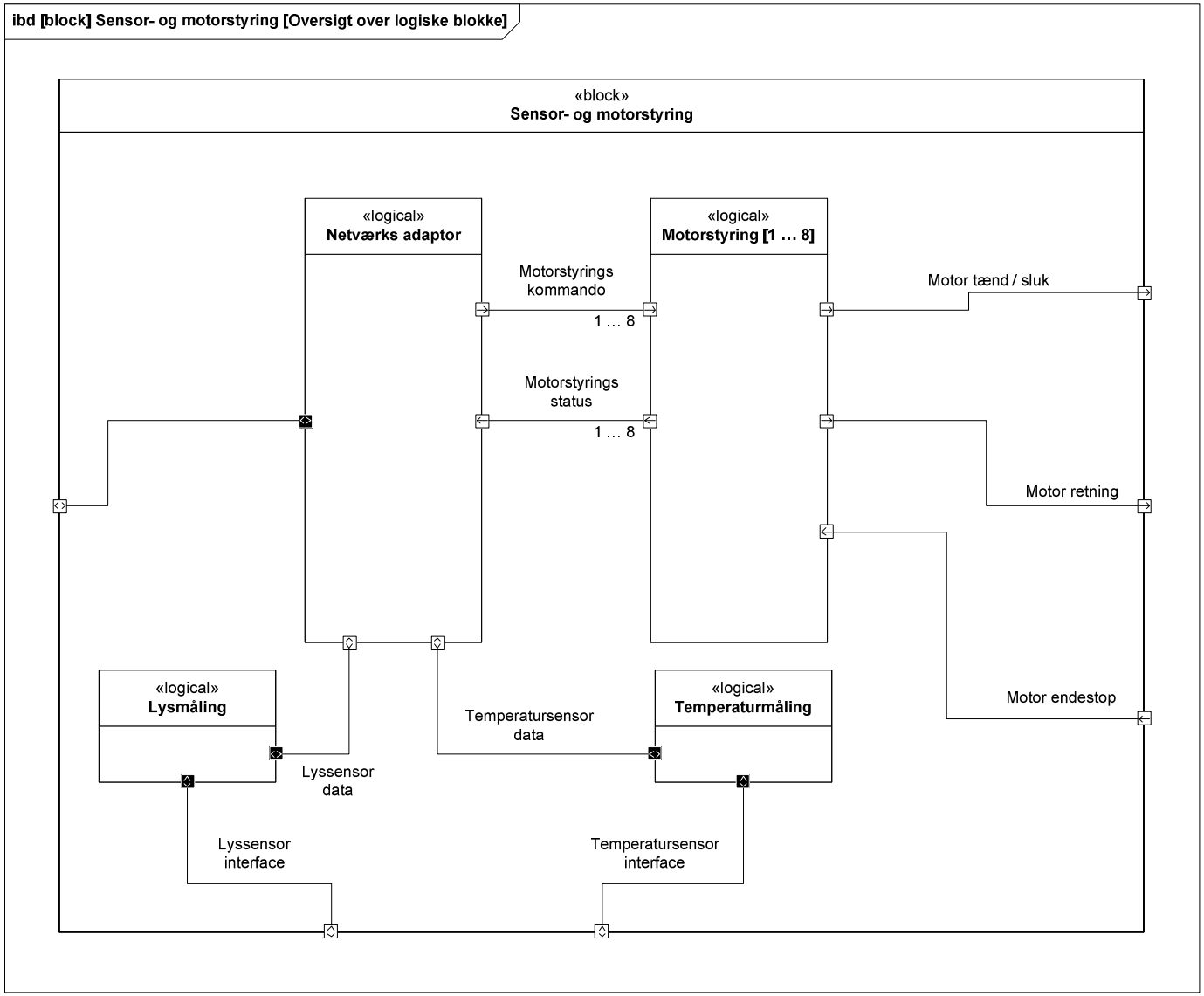
Grænseflader

- Kommunikation mellem enheder
  - Udveksling af information
  - Kontrakt
- Intern og eksterne grænseflader
- Specifikation af grænsefladen
- Protokoller og netværksarkitektur
- Eksterne enheder
  - Messages 
- Intern kommunikation i enhed
  - Basis protokol (processor-memory)
- Opgaver med AIR højtaleren

Arkitektur og Design Model



Systemets struktur



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Beskrivelse

6 Interface-beskrivelse

I dette afsnit beskrives de interfaces, der fremgår af Figur 3.

6.1 Interface mellem vinduesmotor/gardinmotor og motorstyring

6.1.1 Elektrisk interface

Diskret interface, 4 ledere, TTL-niveauer.
[[Yderligere specifikation af elektrisk interface: Tegninger, referencer, etc.]]

6.1.2 Protokol

Leder 0: Fælles GND

Leder 1:
Retning: Motorstyring → Motor
Niveauer: 0: Motor aktiv
1: Motor ikke aktiv

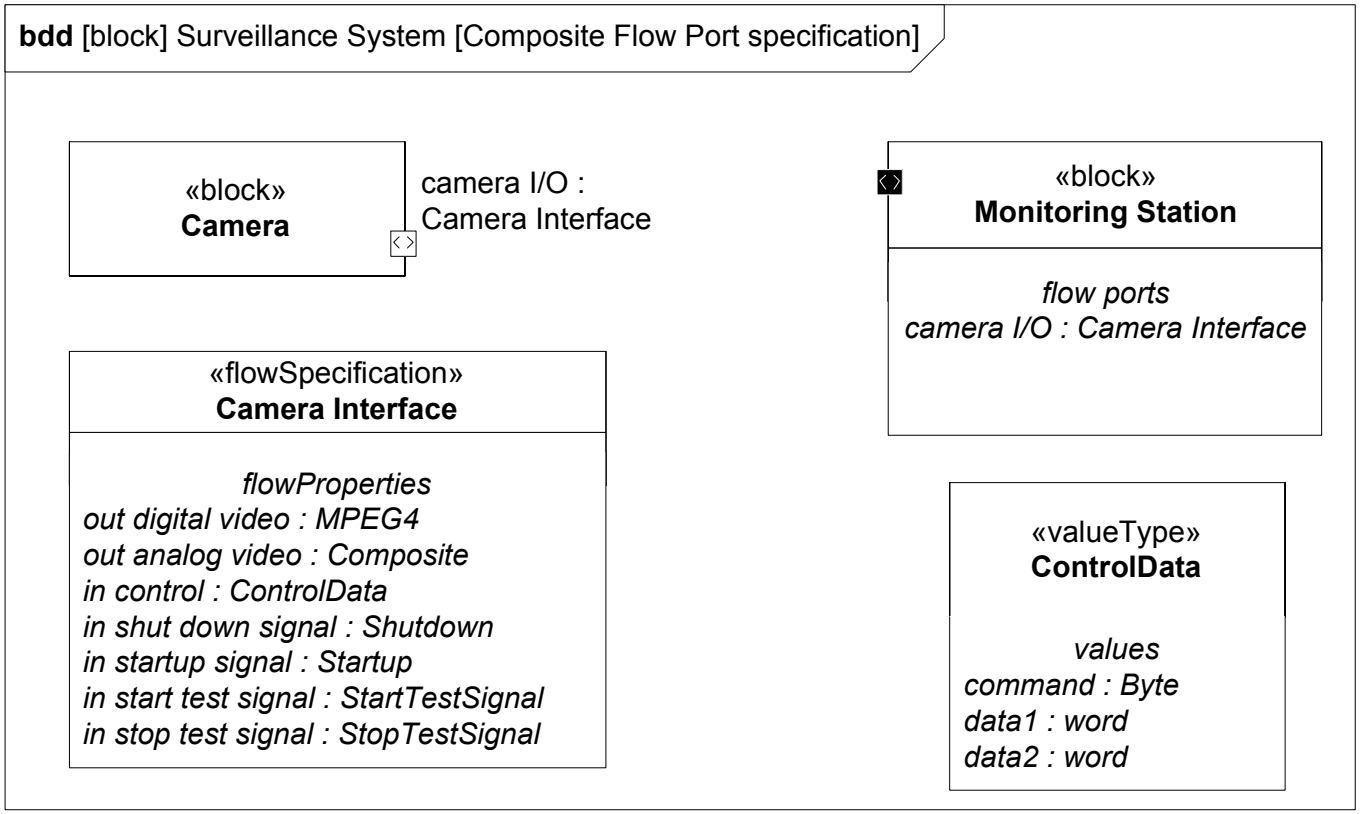
Leder 2:
Retning: Motorstyring → Motor
Niveauer: 0: Motor frem (åbne vindue/rul gardin ned)
1: Motor tilbage (luk vindue/rul gardin op)

Leder 3
Retning: Motor → Motorstyring
Niveauer: 0: Endestop ikke nået
1: Endestop nået

[[Yderligere specifikation af protokol-interface: Tegninger, timingsdiagrammer, etc.]]

Identificer grænseflader (Struktur)

- Arkitekturens struktur
  - Block diagrammer (IBD)
  - Identificer porte og interfaces (flowSpecification)
  - Entydig navngivning af interface



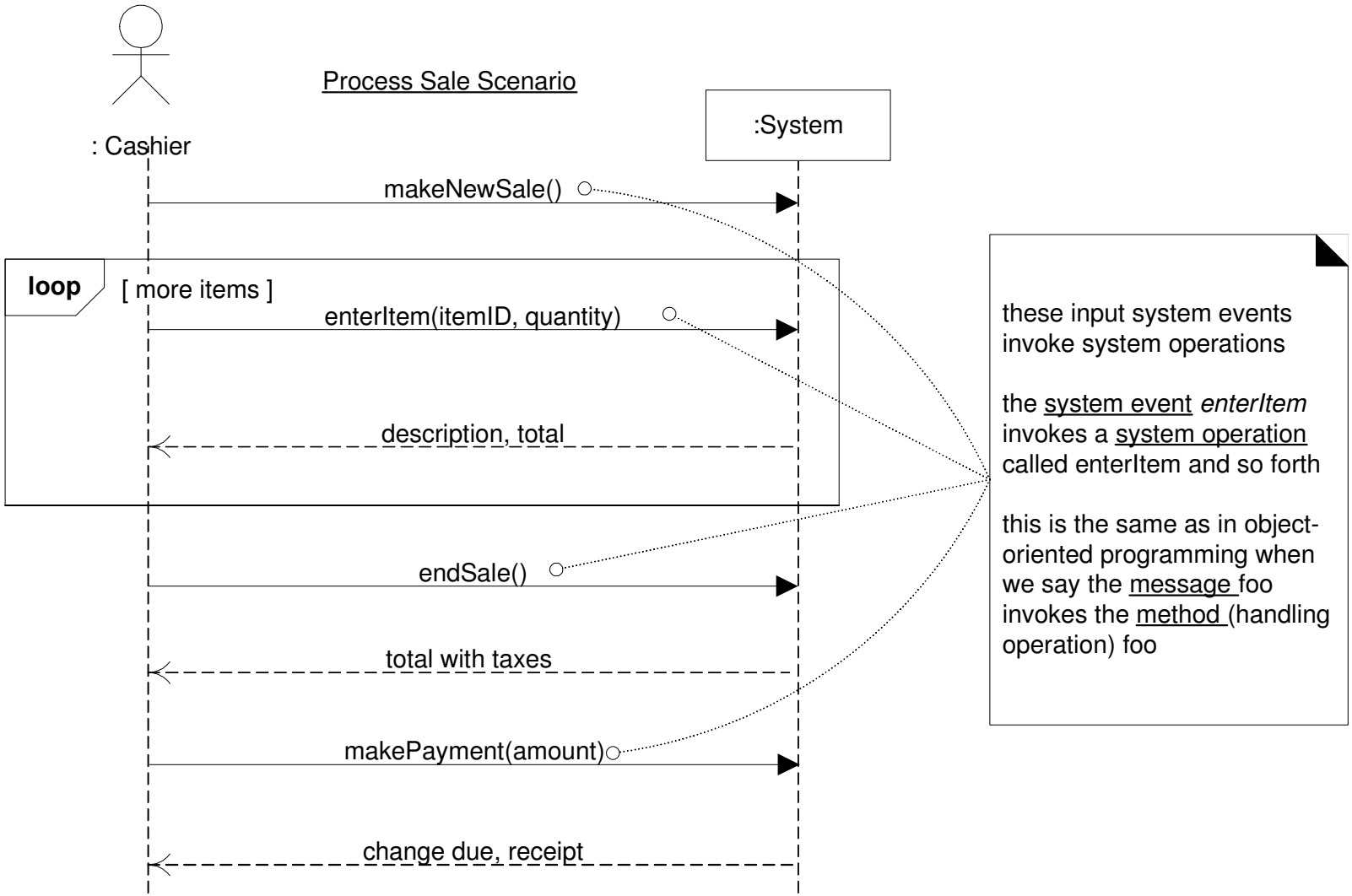
Contracts

- Use cases are the primary mechanism in the UP to describe system behavior and are usually sufficient.
- However sometimes a more detailed description of system behavior has value.
- Contracts for system operations can help define system behavior.
- Contracts can be use in sub-dividing the work

System Operations and the System Interface

- Contracts may be defined for system operations
  - operations that the system as a black box offers in its public interface to handle incoming system events.
- System operations can be identified by discovering these system events.
- The entire set of system operations, across all use cases, defines the public system interface, viewing the system as a single component or class.

Grænseflader (Interaktion)



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Example

Contract C01: makeNewSale

Operation:	MakeNewSale(customer)
Cross Reference:	Use cases: Process Sale
Preconditions:	none
Postconditions:	- A Sale instance s was created - s was associated with a Customer - Attributes of s were initialized

Opgave 1.

Beskriv en kontrakt for operationen ***enterItem***.

Fysiske grænseflader

Examples

System Inputs
- Digital signals level 0 to 4.5VDC

Frequency range:
- High range up to 150.000 MHz
- Midrange up to 50.000 Khz

Voltage Sensitivity
- 50 mV RMS to +/- 5.0 V ac signal

System Outputs

Time interval in range:
- High resolution up to 2.00000 ms
- Measure: 0 – 2.00000 +/- 0.00001 ms

- Fysiske signaler og deres grænser
- Inputs og outputs
- Grænser for spændinger og frekvens
- Standarder

System sample rates	
Internal sample rate	192 and 176.4 via Dual Wire (optional Digital Card required) and
	96, 88.2, 64, 48, 44.1 or 32 kHz
AIR Masters only	
I/O Connectors	XLR (2 channels AES/EBU in) 3 x RJ45 proprietary TC LINK
Formats	AES/EBU (24 bit)
Word clock input	BNC, 75 ohm, 0.6 to 10 Vpp
Display	2 x 16 character dot matrix
Operation	Menu system / four buttons
Analog input option	
Input connectors	XLR balanced (pin 2+, pin 3-)
Impedance	10/3 k Ohm (Balanced/unbalanced)
Selectable full scale input level	+9, +15, +21, +27 dBu
Dynamic Range	> 113 dB typ. (unweighted), BW: 20-20kHz
THD+N	< -105 dB typ. @ 1 kHz, -3 dBFS
Crosstalk	< -120 dB, 20 Hz to 20 kHz
A to D Conversion	24 bit (Dual bit delta sigma sampling at 4.1/5.6/6.1/6.1 MHz)
AIR Slaves only	
I/O Connectors	2 x RJ45 proprietary TC LINK

Eksterne grænseflader

- Forbindelser imellem enheder
  - Serielle (USB, RS232…)
  - Parallelle (Bus)
  - Netværk (TCP/IP)
  - Trådløse (ZigBee, Bluetooth)
  - …..

Interne grænseflader (Bus)

- Processor og Memory
  - Bus (parallel, adresse, data og kontrolsignaler)

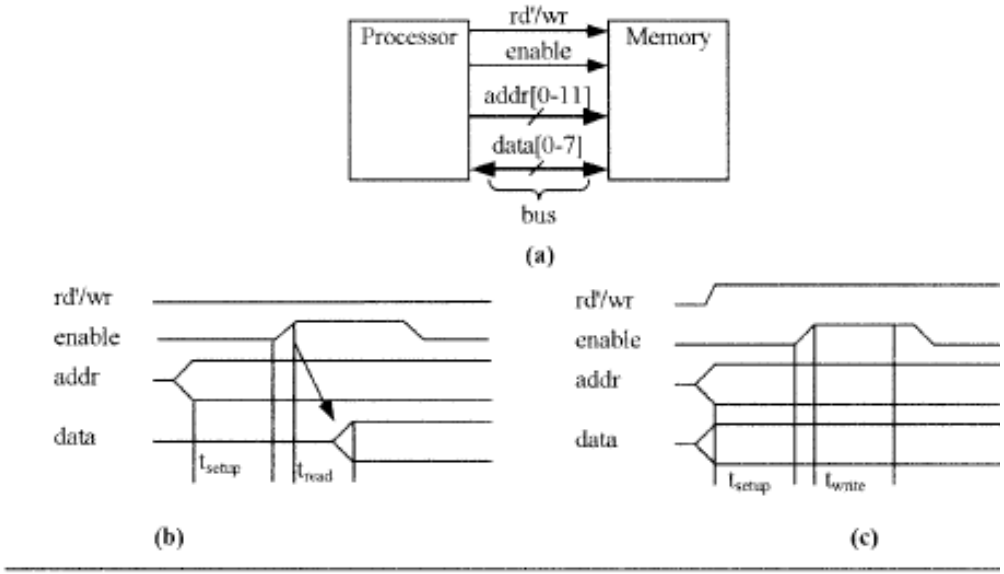


Figure 6.1: A simple bus example: (a) bus structure, (b) read protocol, (c) write protocol.

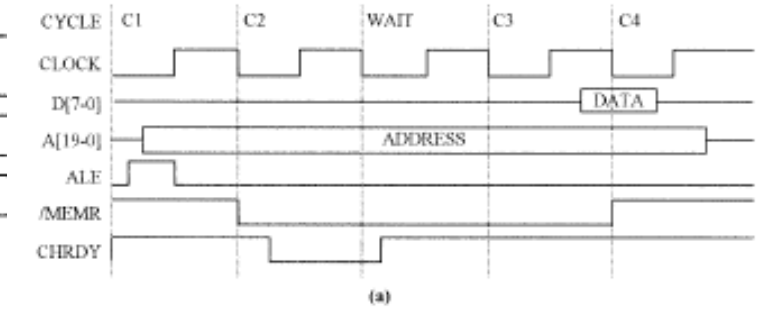
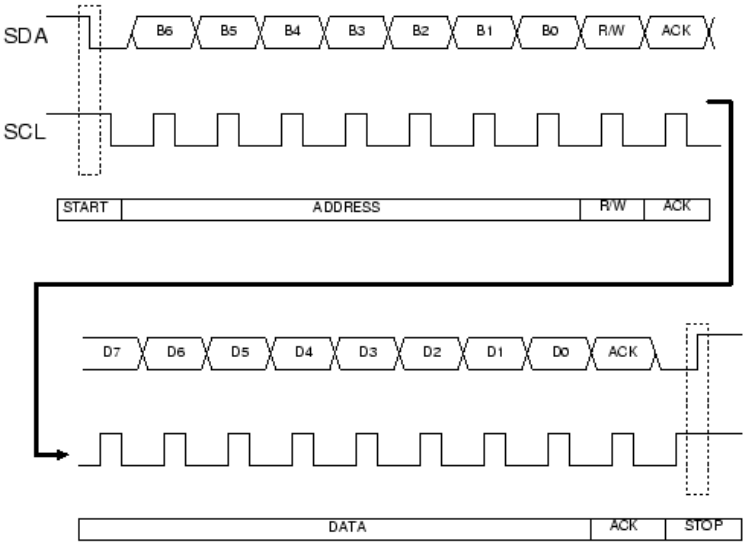


Figure 6.5: ISA bus protocol: (a) read bus timing, (b) write bus timing.

Interne grænseflader (Komponenter)

- Processor og eksterne komponenter
  - Parallel (Bus, Porte) eller Seriel (I2C, SPI…)
  - Interrupts



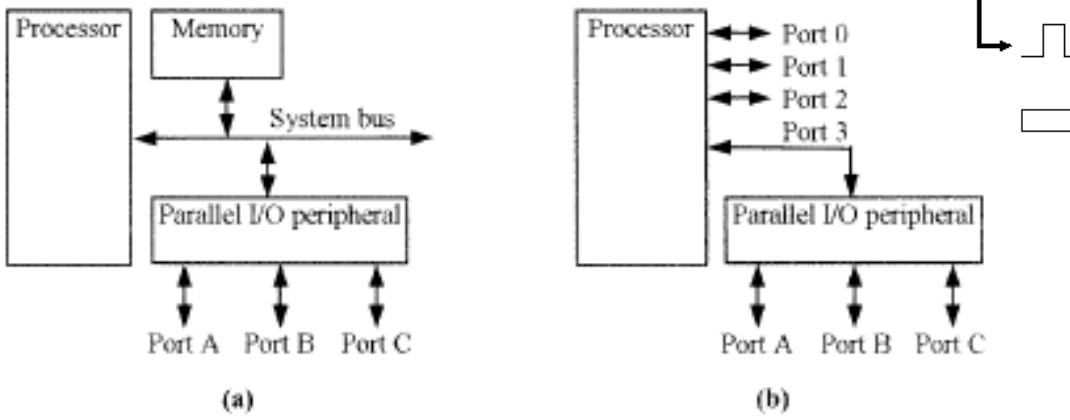
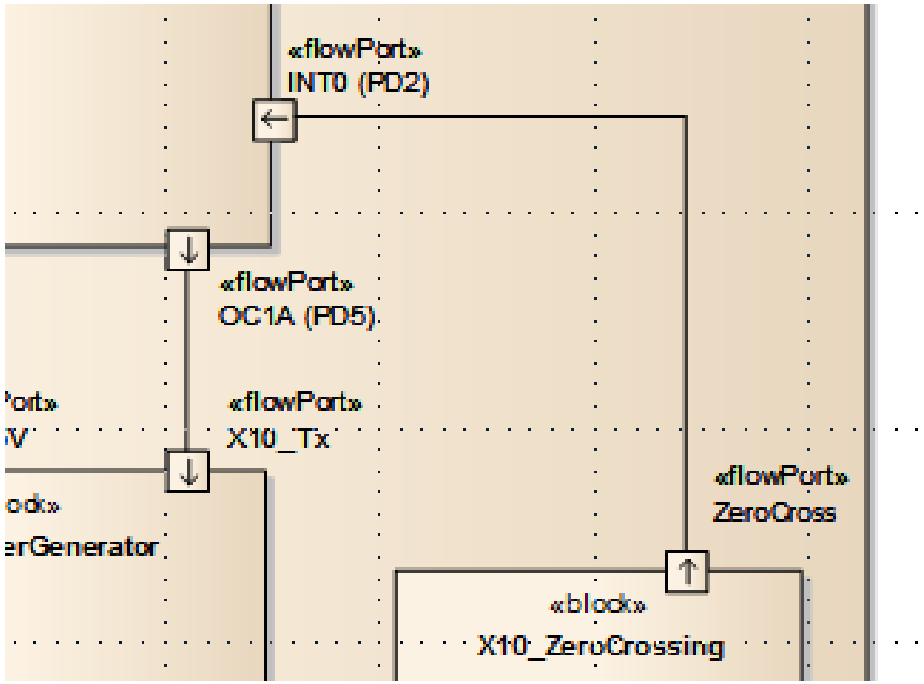


Figure 6.6: Parallel I/O: (a) adding parallel I/O to a bus-based I/O processor, (b) extended parallel I/O.

Grænseflader mellem HW/SW

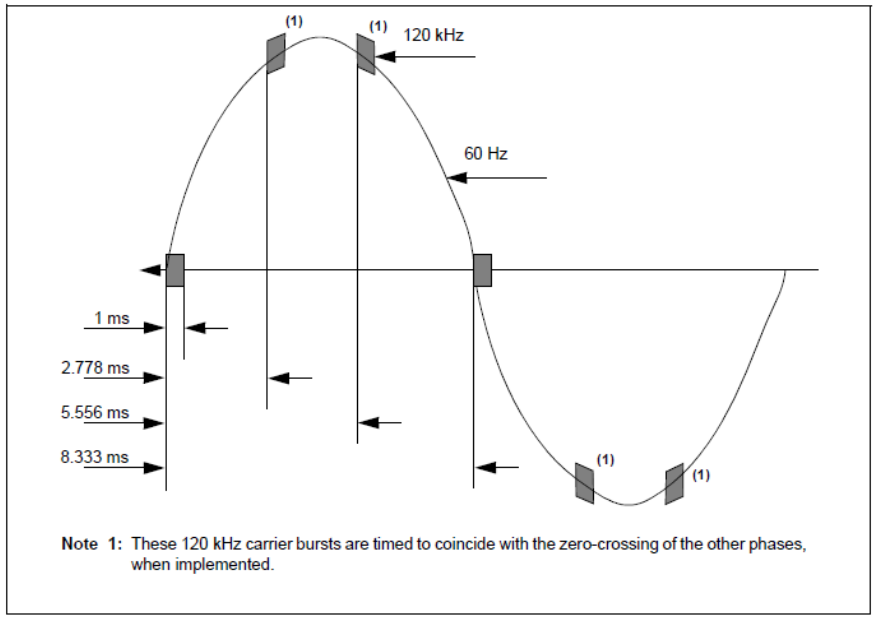
- Hvilke digitale porte benyttes?
- Hvilke interrupts benyttes?
- Hvilke digital signaler har grænseflade til processoren?
- Hvordan opsættes registrerer?



Opgave 2. Timings diagram

- Skitser et timings diagram for X.10 kommunikation mellem hardware og softwaren
- Diagrammet skal beskrive en X.10 receiver
  - Et 50 Hz power med moduleret 120 kHz (se figur nedenfor) (**Px**)
  - Et signal der skifter hver gang vi har en nul gennemgang (**Zc**)
  - Et digital signal som er høj når der detekteres 120 kHz (**Rx**)
  - Hvilke krav har vi til signal forsinkelser og holde tider? (**td, th**)

FIGURE A-1: X-10 TRANSMISSION TIMING



Note 1: These 120 kHz carrier bursts are timed to coincide with the zero-crossing of the other phases, when implemented.

Layered protocols

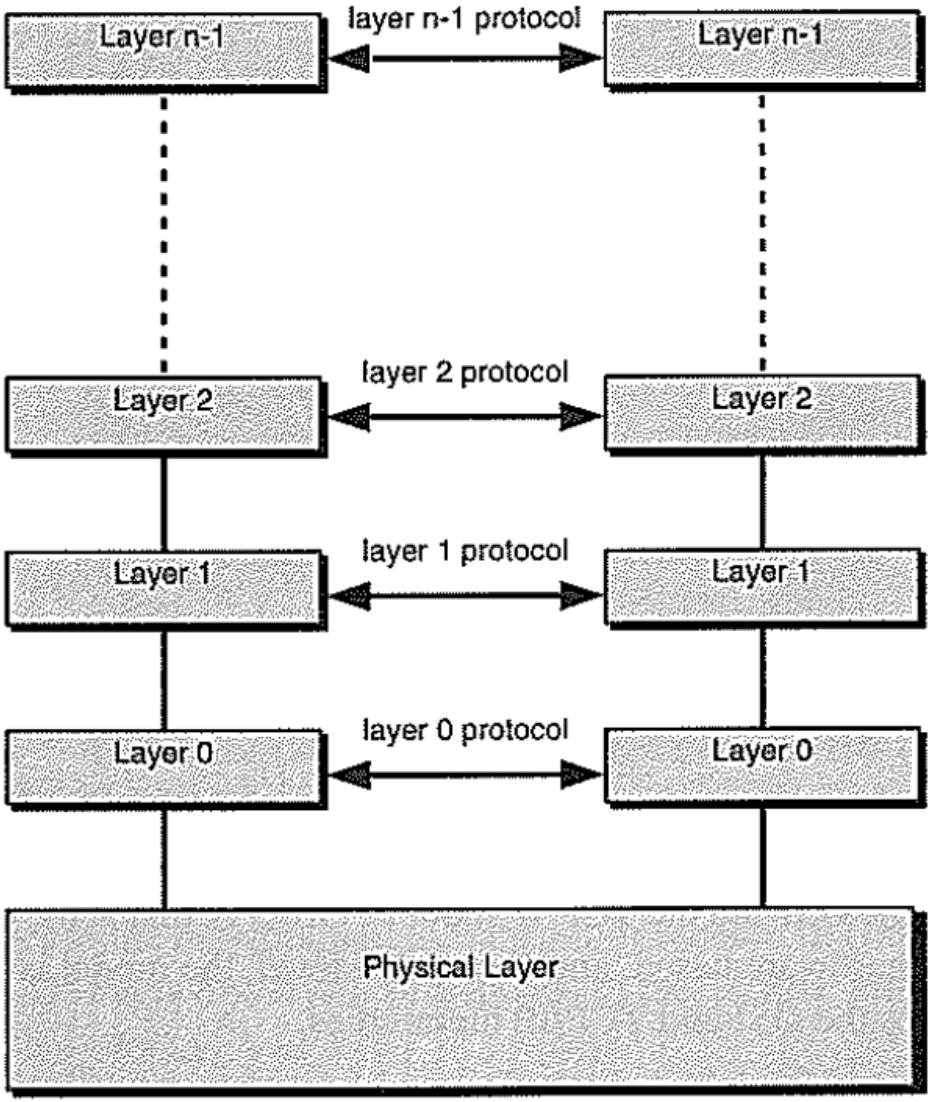
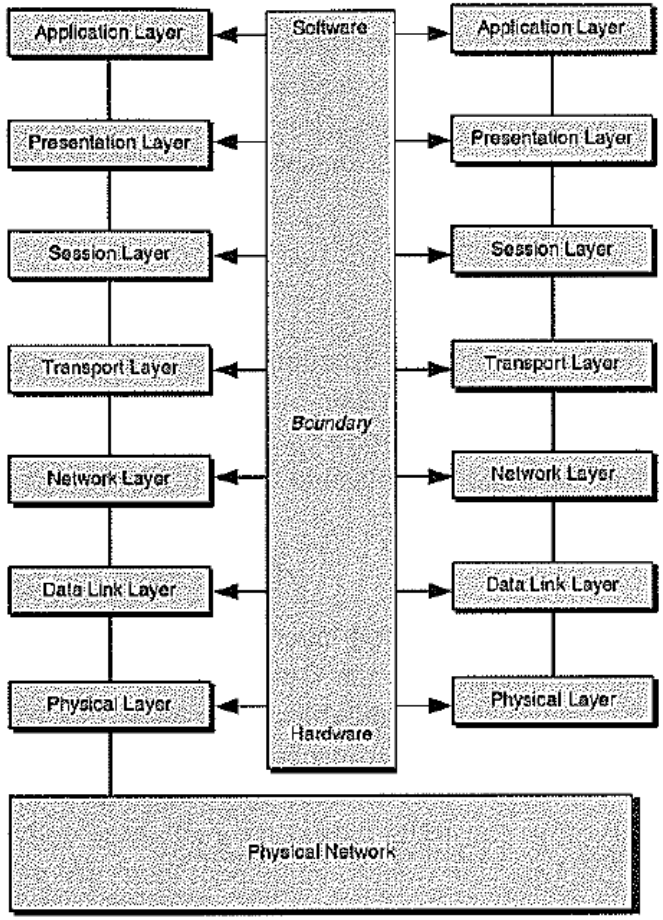


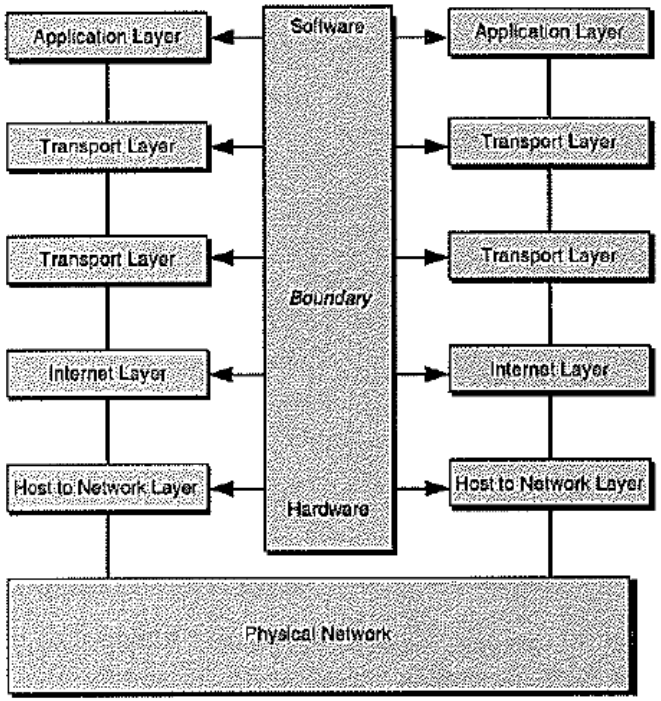
Figure 16.40 An N Layer Network Architecture

OSI protokollen

- International standard for opbygning af protokoller



OSI Hierarchy



TCP/IP Hierarchy

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OSI lag

- Physical Layer
  - Flytter bits over en kommunikationskanal
  - Mekanisk og elektrisk grænseflade
  - Hvordan etableres forbindelsen
- Data Link Layer
  - Flytter frames som er en samling af bits
  - Kvittering fra modtager (Acknowledgement)
- Transport Layer
  - Opdeling af data i pakker
  - Eks. Internet
    - Transmission Control Protocol (TCP)
    - User Datagram Protocol (UDP)
- Application Layer
  - Kommunikation mellem programmer – remote procedure eller objekter

Client/Server model

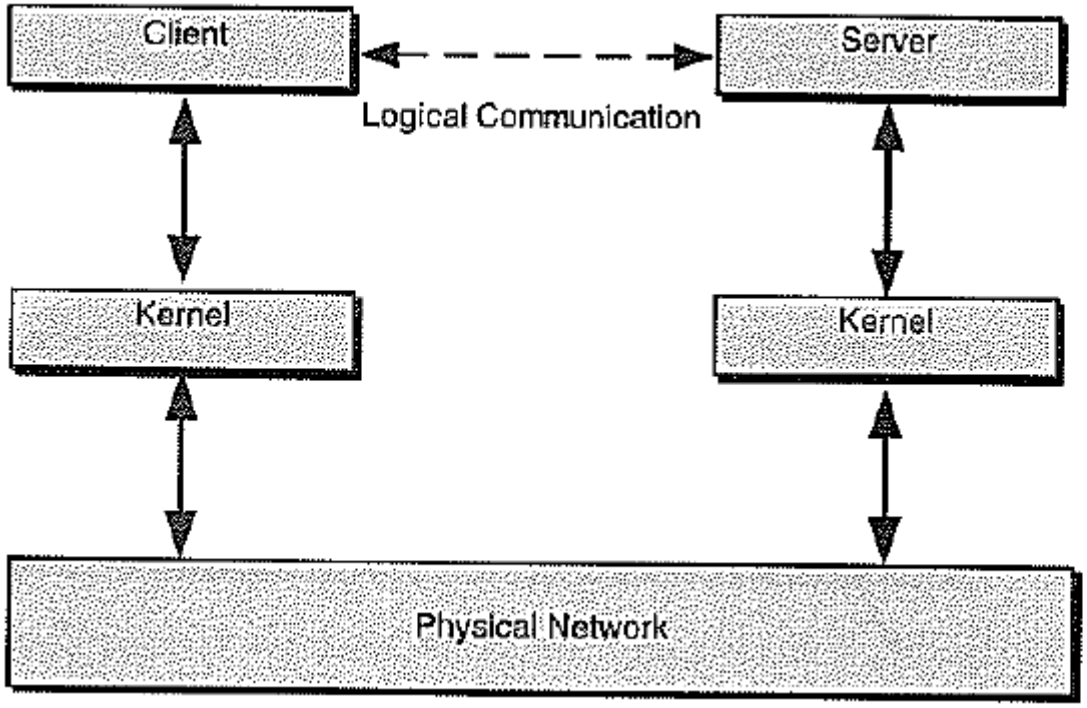


Figure 16.51 A High-Level View of a Client-Server Model

Eksempel på messages

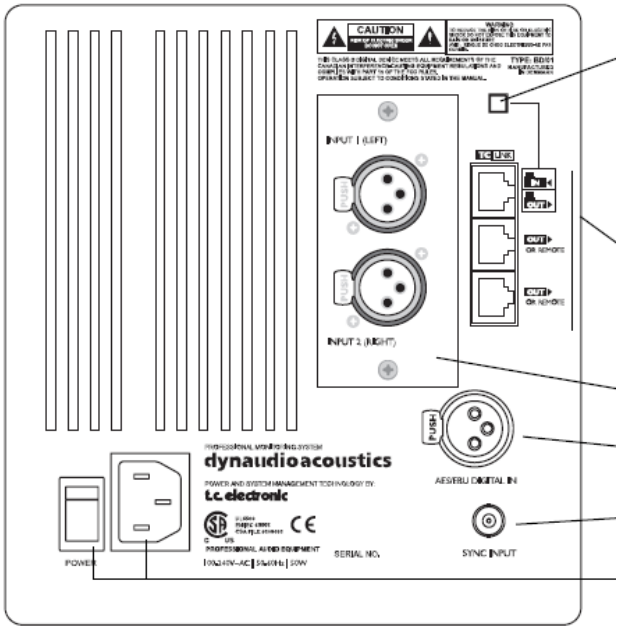
- Data Link Layer

Figure 16.47 A Header Added to the Basic Message

Figure 16.48 The Basic Message Decomposed into Packets

Grænseflade – TC Link
Eksempel

Master Unit - Analog I/O



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Analysis and Design Steps (Summary)

- Input a textural requirements specification (Eg. Use Case)
  (Or expert knowledge of the domain and desired system)

Analysis - steps

- *Actor Interaction* with the system (Sequence diagram)
- *Domain Model* (Class Diagram)

Architecture design:

- *Subsystems* (Block Definition Diagram)

SW Design

- *Application Model* for subsystems (Class, sequence and states)
- *Logic Model* (Packages – SW subsystems)

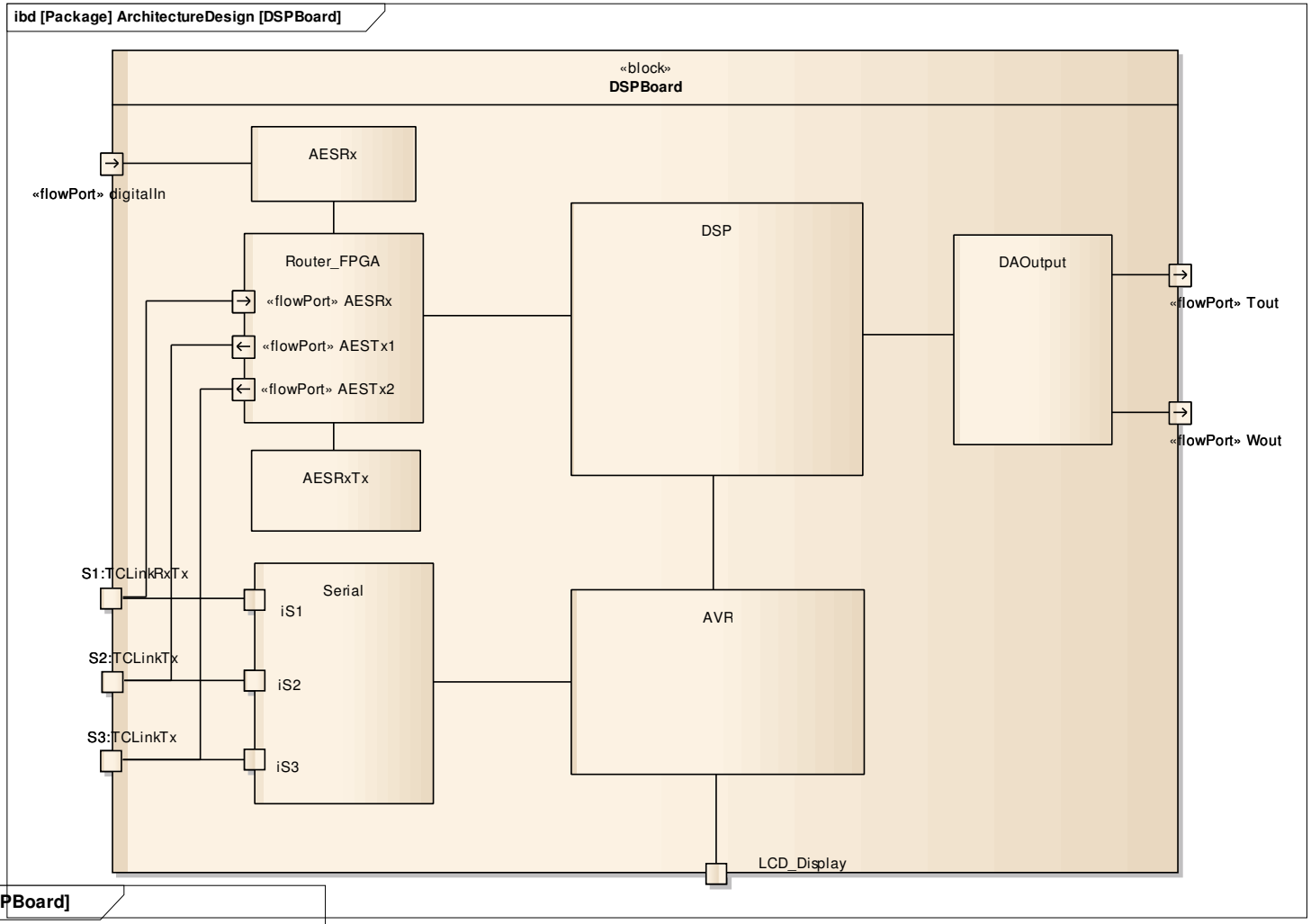
HW Design

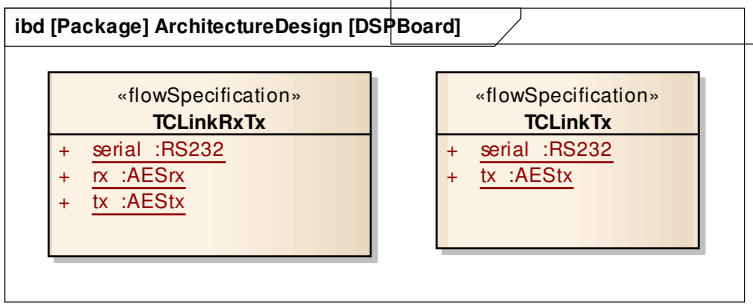
- *Platform Model* for subsystems (Internal Block Diagram)
- *Deployment Model* (Allocation of logical model to platform)

Interface Design

- *Identification and specification between subsystems* (HW+SW)

HW Design – Platform Model for AirMonitor (Subsystem)





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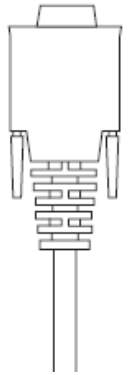
TCLink interface

- TCLinkRxTx – (System Controller = output)
  - RJ45 Link connector (8 wires)
  - **Input or Output** of stereo digital audio (AES format)
  - Serial control information (Tx/Rx)
- TCLinkTx
  - RJ45 Link connector (8 wires)
  - **Output** of stereo digital audio (AES format)
  - Serial control information (Tx/Rx)

TC LINK Standard Cat-5 cables

Maximum Cable Length	:	15 meter.
Cable type	:	Shielded Ethernet Cable Category 5.
Connector type	:	RJ45

This connection is carrying Digital audio (24 bit) and network control information.

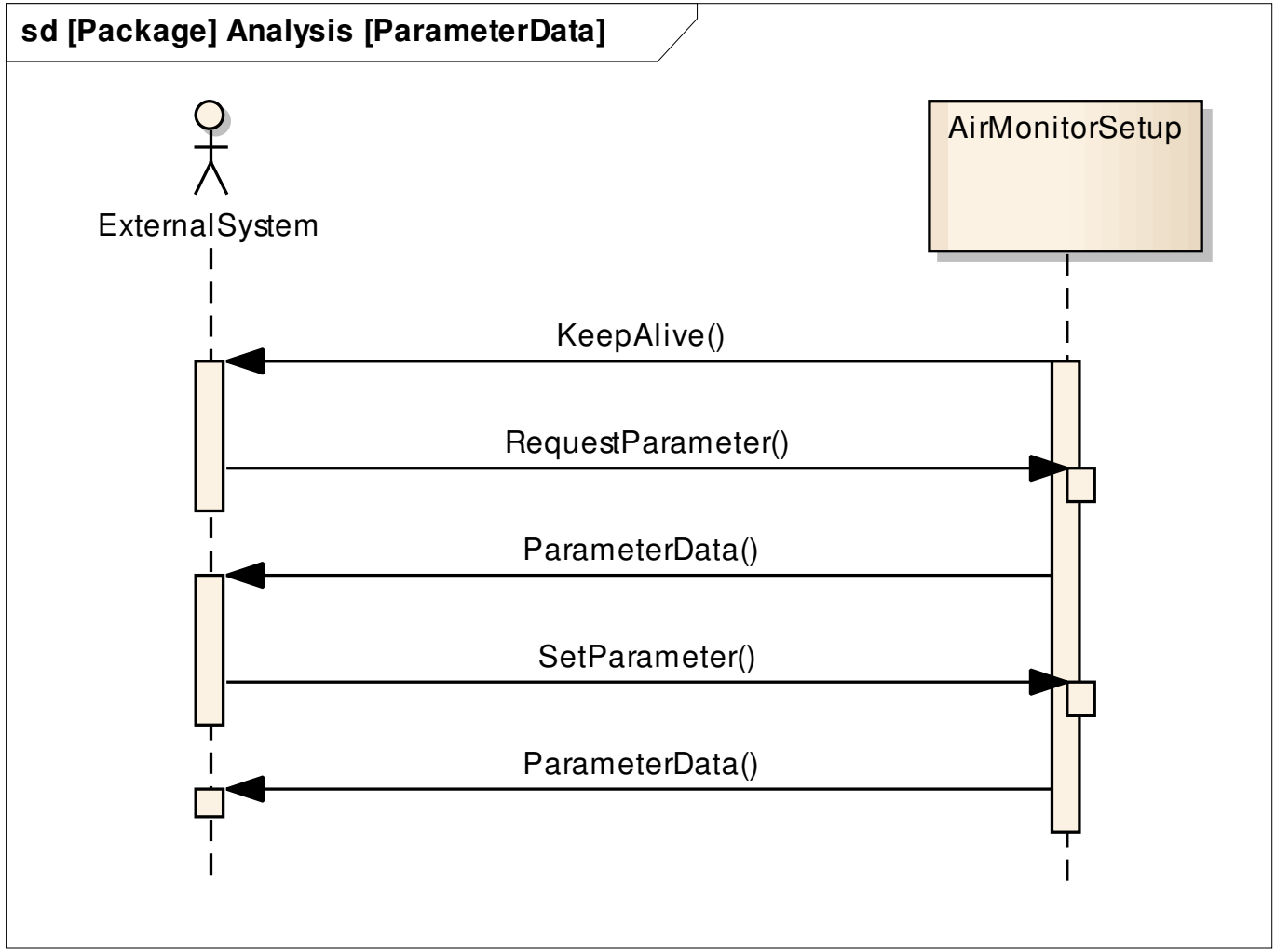


TC Link – Physical layer

- MIDI protocol running on 19200 baud. Normal MIDI speed is 31,25 kbps.
- The physical layer is based on current loop 5 mA RX/TX with special converters to interface a PC with RS232. (COM port)
- Digital audio data is transmitted at 96 Khz with a 24 bits resolution

- http://www.midi.org/aboutmidi/tut_techomidi.php
- http://www.gweep.net/~prefect/eng/reference/protocol/midispec.html

Application Layer Interaction



Keep Alive message

Keep Alive
A message that is composed by 3 MIDI bytes sent from the System Controller to all devices in the network. The message indicates that the system is turned on.

0xFE	MIDI status (Active Sense)
<Device ID>	Source address of the Keep Alive message (0)
<Status>	Status for monitor network, values 0 - 127

General message format

General AirSysEx messages

The format of the AirSysEx message starts with an 8 bit start byte (0xF0) and terminates with an 8 bit termination byte (0xF7). All bytes in the body of the AirSysEx message contain byte values in the interval 0-127.

0xF0	MIDI System Exclusive message start
<Device ID>	Air System Exclusive destination device ID
<Message type>	Air network message type
<Data>	Data depends on message type
...	...
...	...
<Chk>	Block check sum (From start to here)
0xF7	MIDI System Exclusive message terminator

Request parameters

Request Parameter

0xF0	SysEx
<Device ID>	Destination Device ID
0x47	SYXTYPE_ PARAMREQ
<Source ID>	Device ID of unit that asks for Parameter Data
<Param group>	Global parameter (0)
<Param ID>	Base parameter identifier
<Count 2>	7 MSB Number of desired consecutive parameters
<Count 1>	7 LSB Number of desired consecutive parameters
<Chk>	Block check sum (From start to here)
0xF7	EOX

<Source ID>

The source address of the network device that is requesting parameters. The source ID = 127 indicates an external computer sending a parameter request.

<Param group>

Parameter group 0 identifies global parameters as described below.

Parameter ID

<Param ID>
Contains the parameter ID offset to the list of parameters to access in the AIR monitor network as listed in the table below.

Global parameter name	ID	Min value	Max value	Note
GLOBAL_MASTERVOLUME	0	-120	1000	1
Reserved	1			
GLOBAL_BASSMANAGE	2	0	11	2
GLOBAL_ACTIVE_REFLEVEL	3	0	3	3
GLOBAL_REFLEVEL1	4	-120	1000	1
GLOBAL_REFLEVEL2	5	-120	1000	1
GLOBAL_REFLEVEL3	6	-120	1000	1
Reserved	7			
Reserved	8			
GLOBAL_MUTE	9	0	Bits (0-13)	4
GLOBAL_LOAD_PRESET	10	0	32	5
Reserved	11-32			

Opgave 3.

- Studer dokumentet **AirControlProtocol.pdf** (CampusNet)
- Lav et protokol eksempel med kommando for læsning af de globale parameter (ID: 0-10)
  - Request Parameter: 0xF0 0x00 0x47…..
- Lav et protokol eksempel, hvor en besked modtages at volumen er ændret til -20 dB.
  - Parameter Data: 0xF0 0x7F …..

Løsning 3.

- **Request Global Parameters 1-10**
  - **Request Parameter**
    - 0xF0 0x00 0x47 0x36 0x00 0x00 0x00 0x0a <Chk> 0xF7

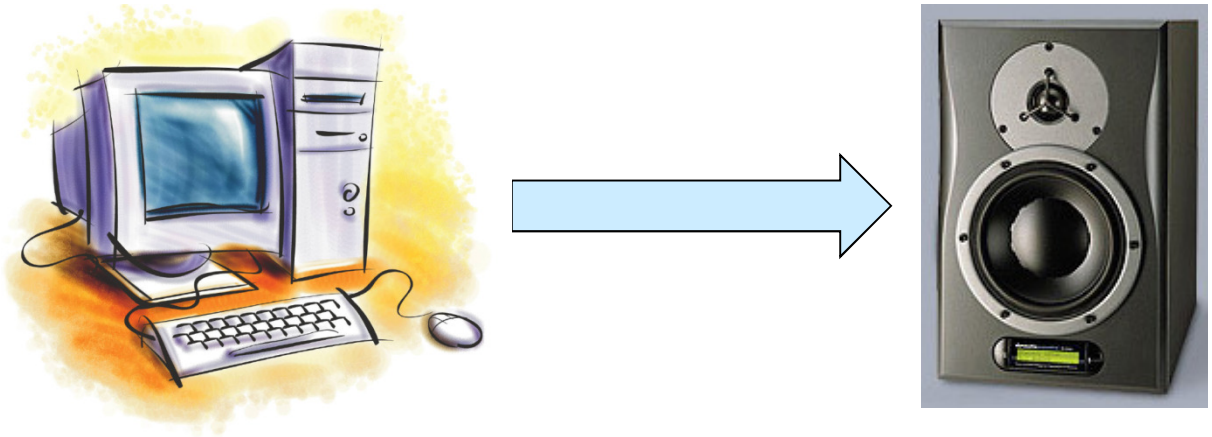
Request Parameter
0xF0
<Device ID>
0x47
<Source ID>
<Param group>
<Param ID>
<Count 2>
<Count 1>
<Chk>
0xF7

- **Volume set to -20 dB**
  - Parameter Data – global parameter 0, volume -20 dB = 0xC8 (200)
    - 0xF0 0x7F 0x00 0x22 0x00 0x01 0x48 <Chk> 0xF7

Parameter Data
0xF0
<Device ID>
0x22
<Param group>
<Param ID>
<Data 1>
<Data 2>
…
<Chk>
0xF7

Opgave 4. Test protokol til Air (1/2)

- Specificer en seriel protokol for kommunikation mellem en PC og tilsluttet Air Højtaler
- Målet er at man fra en tilsluttet PC kan sende kommandoer til at teste højtaleren i forbindelse med produktionstest
- Der skal benyttes ASCII værdier så man med et tilsluttet terminal program manuel kan sende kommandoerne
- Protokollen er basseret master/slave princippet



Opgave 4. Test protokol til Air (2/2)

- Specificer den fysiske grænseflader (TC Link)
  - Hastighed, start/stop bits, paritet mm. (Se AIR manualen)
- Protokollen bruger master/slave princippet med følgende kommandoer
  - *Set Analog Gain: 0, -6, -12, -18 db*
  - *Set and Read Sample Rate: 44.1, 48, 88.2, 96 kHz*
  - *Set Volume: 0 to 1000 (times -0.1 db)*
  - *Write and Read Serial number: <nnnnnn>*
  - *Read Software version: returns a text string*
  - *Echo a string to display (2x16 characters)*
- Der skal sendes et svar med OK eller fejl fra højtaleren
- Tegn et sekvens diagram for set og læsning af serie nummeret (Write and Read Serial number)