

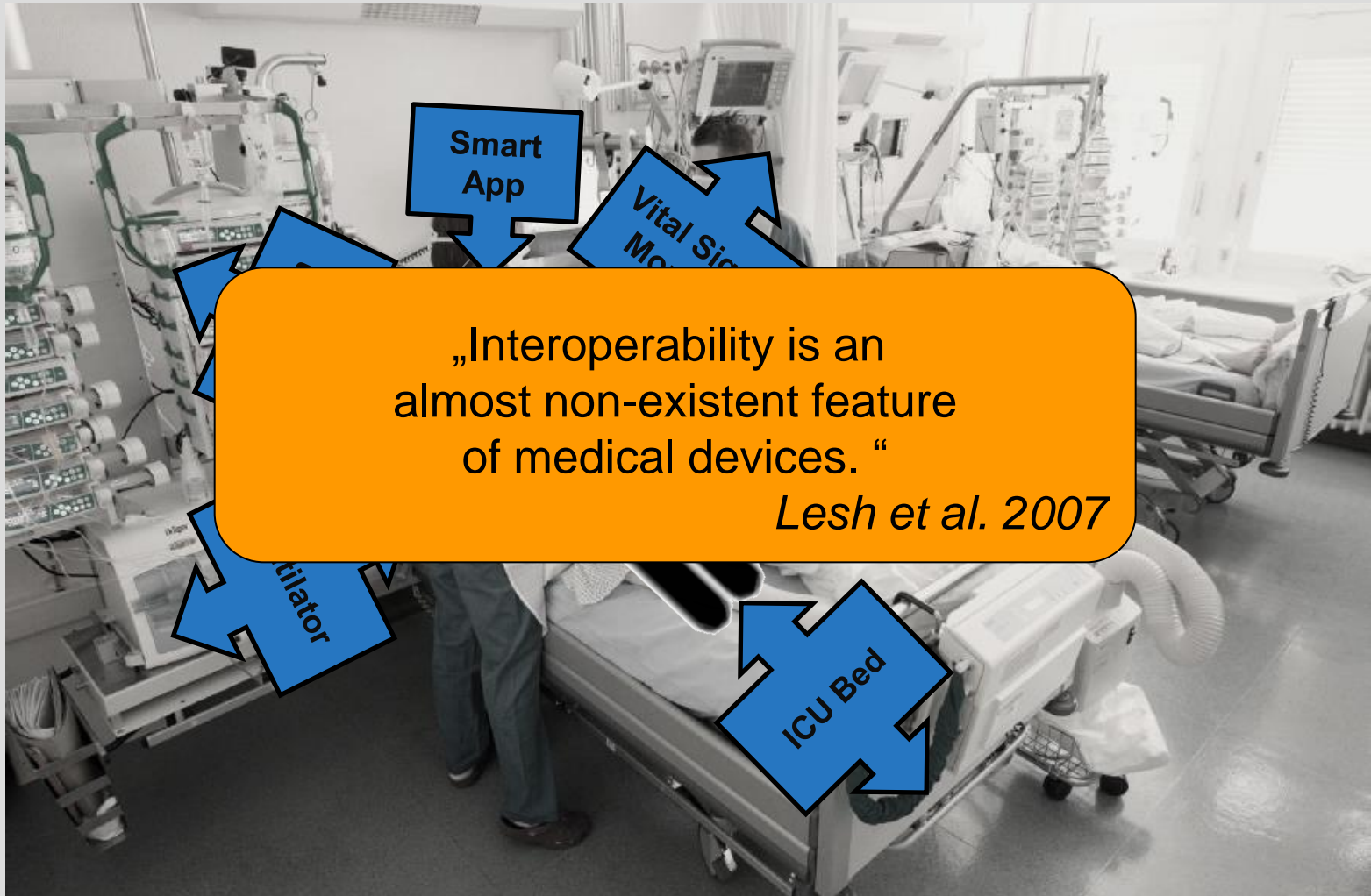
An architecture for medical cyber physical systems in high acuity environments

KoSSE-Tag 2015, Lübeck
2015/06/03, Stefan Schlichting

-
- 1. Introduction**
 2. Clinical Workplace SOMDA
 3. Protocol Stack
 4. Results
 5. Discussion
-
-

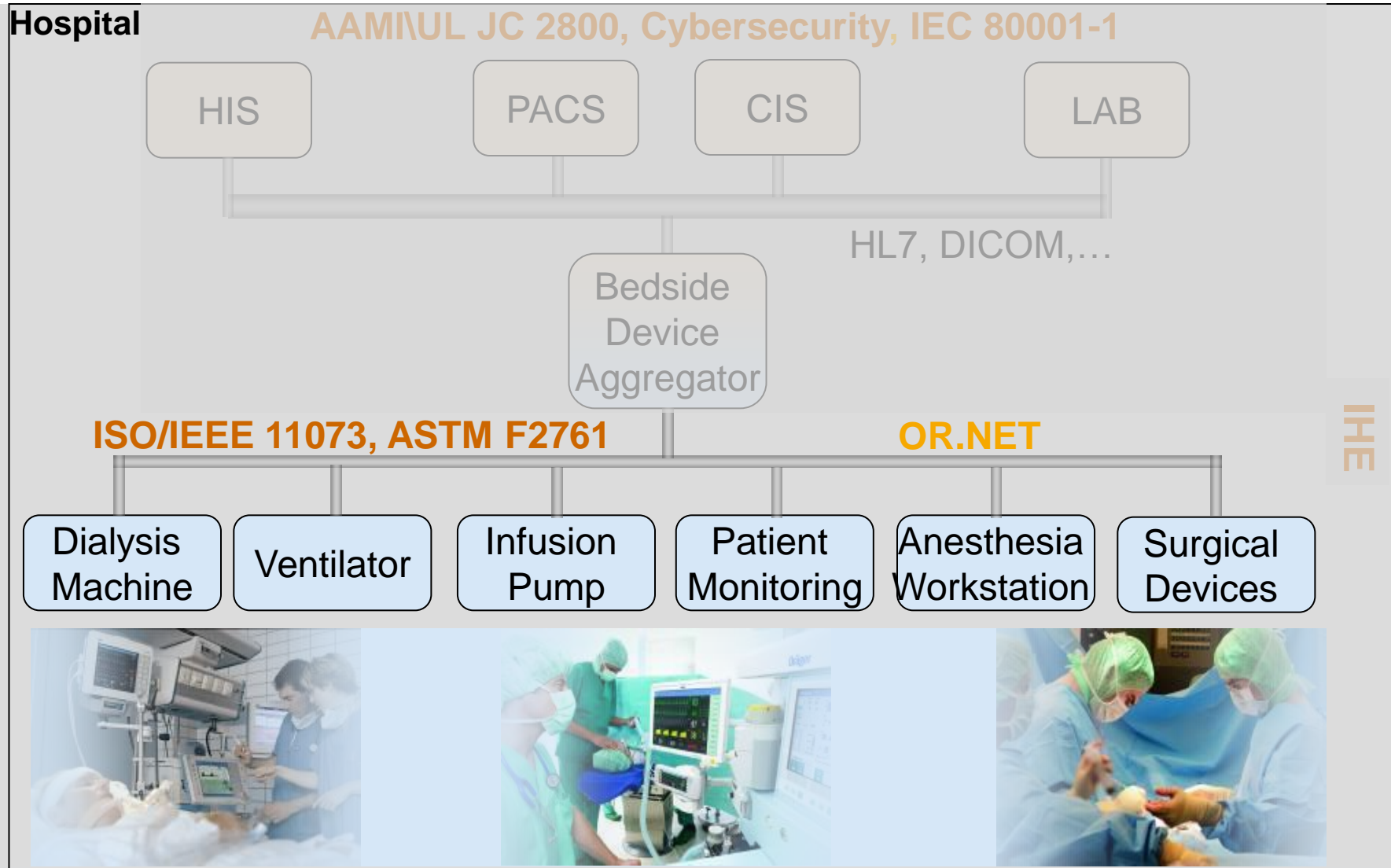
Introduction

The Interoperability Problem



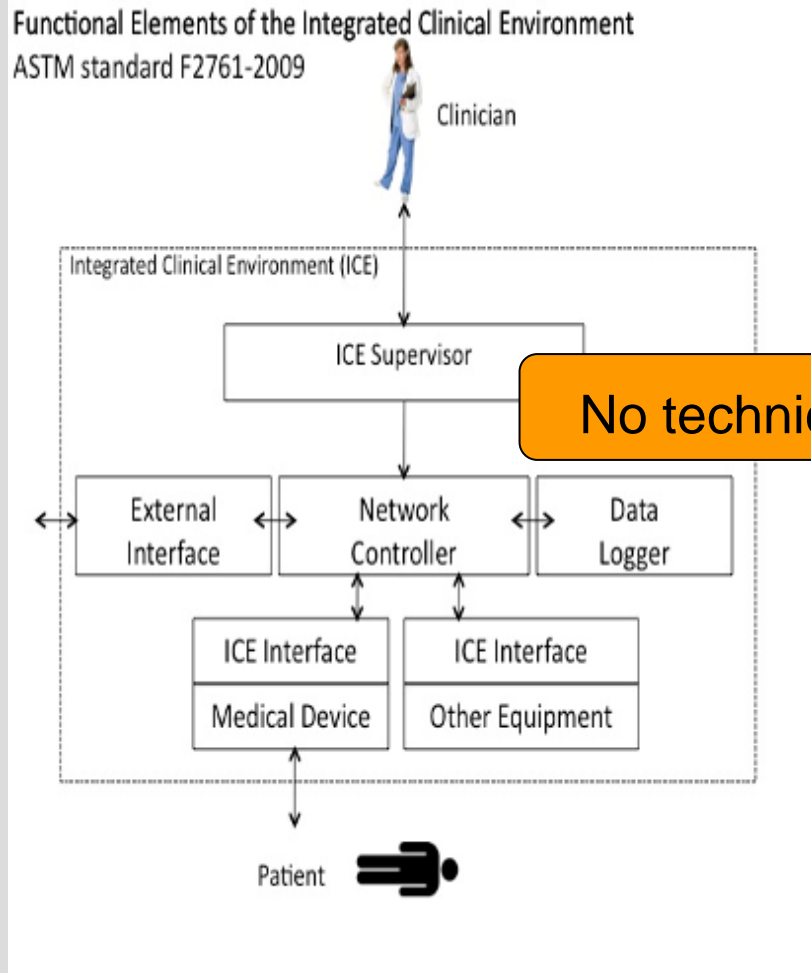
Introduction

Interoperability Standards in the Hospital



Introduction

ASTM F2761 - Integrated Clinical Environment



No technical specification!

Essential safety requirements for equipment comprising the patient-centric integrated clinical environment (ICE)

— Part 1: General requirements and conceptual model

- Requirements for **safe and effective integration** of devices environments
- Functional conceptual model for the setup of an **Integrated Clinical Environment**
- Components are described on an abstract level

Introduction

Medical device interoperability requirements in an ICE

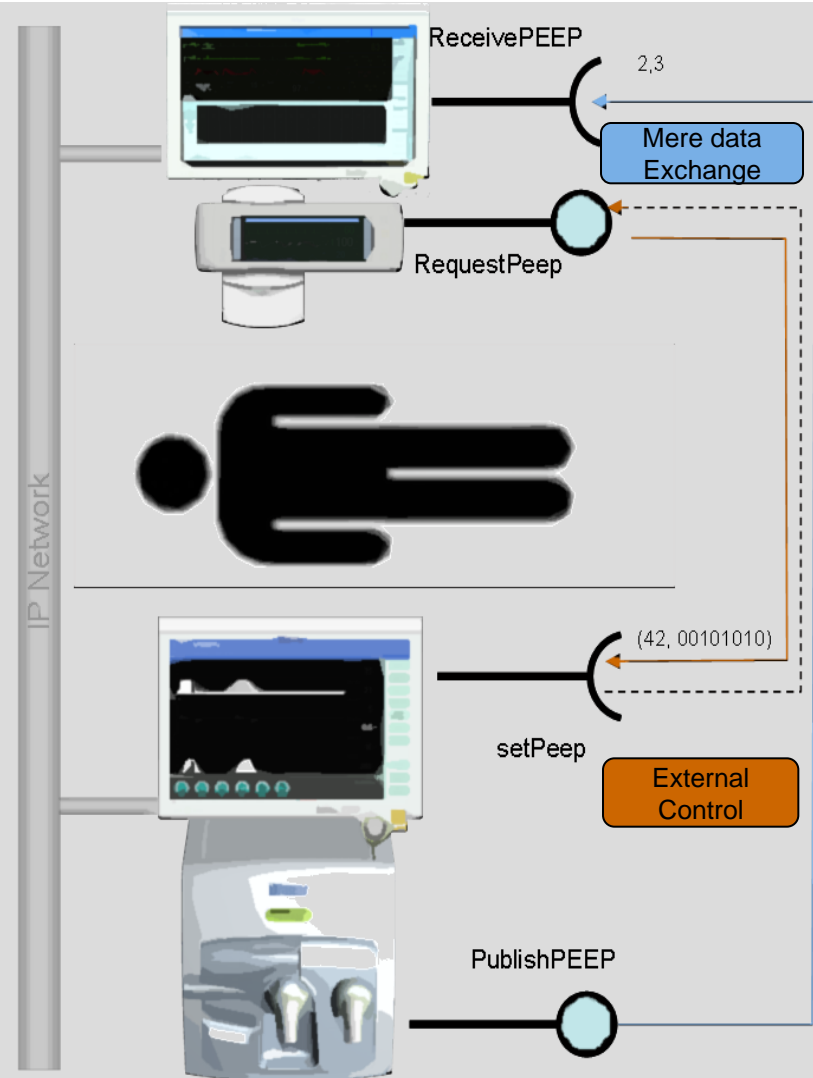
Medical Device Interoperability in high acuity clinical workplace environments ,

that is

... reliable cross-device data exchange between medical devices
 ... external control with focus on patient safety

without tight system integration, yielding a flexible technical infrastructure

for smart medical cyber physical system apps.



Introduction

Medical device interoperability requirements in an ICE

Functional

Plug'n Play

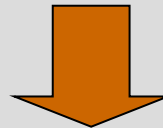
- Discovery and Binding
- Device capability description at runtime
- Extensibility & Openness

Communication (1-1, 1-n, n-n)

- Event Notification
- Data reporting
- External control

Non-Functional

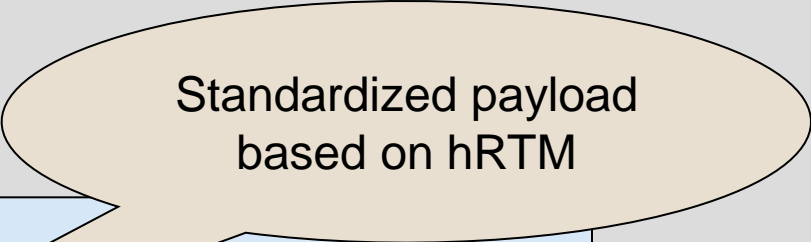
- Risk Management
- Safe communication
- Access control
- Trust establishment between participants
- Privacy of patient-related data
- Latency in milliseconds range



Core Concept

Develop an interoperability architecture & protocol stack

- based on **standardized technologies for syntactic interoperability**
- and proprietary or **standardized protocols** for semantic interoperability.



-
1. Introduction

 - 2. Clinical Workplace SOMDA**

 3. Protocol Stack

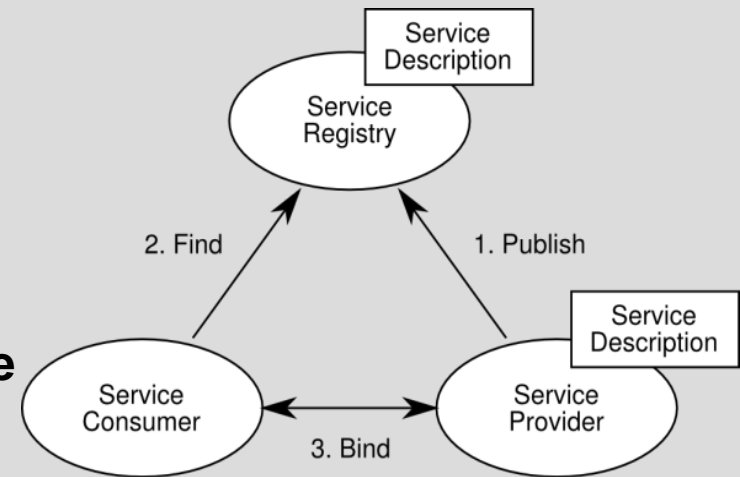
 4. Results

 5. Discussion

Clinical Workplace SOMDA

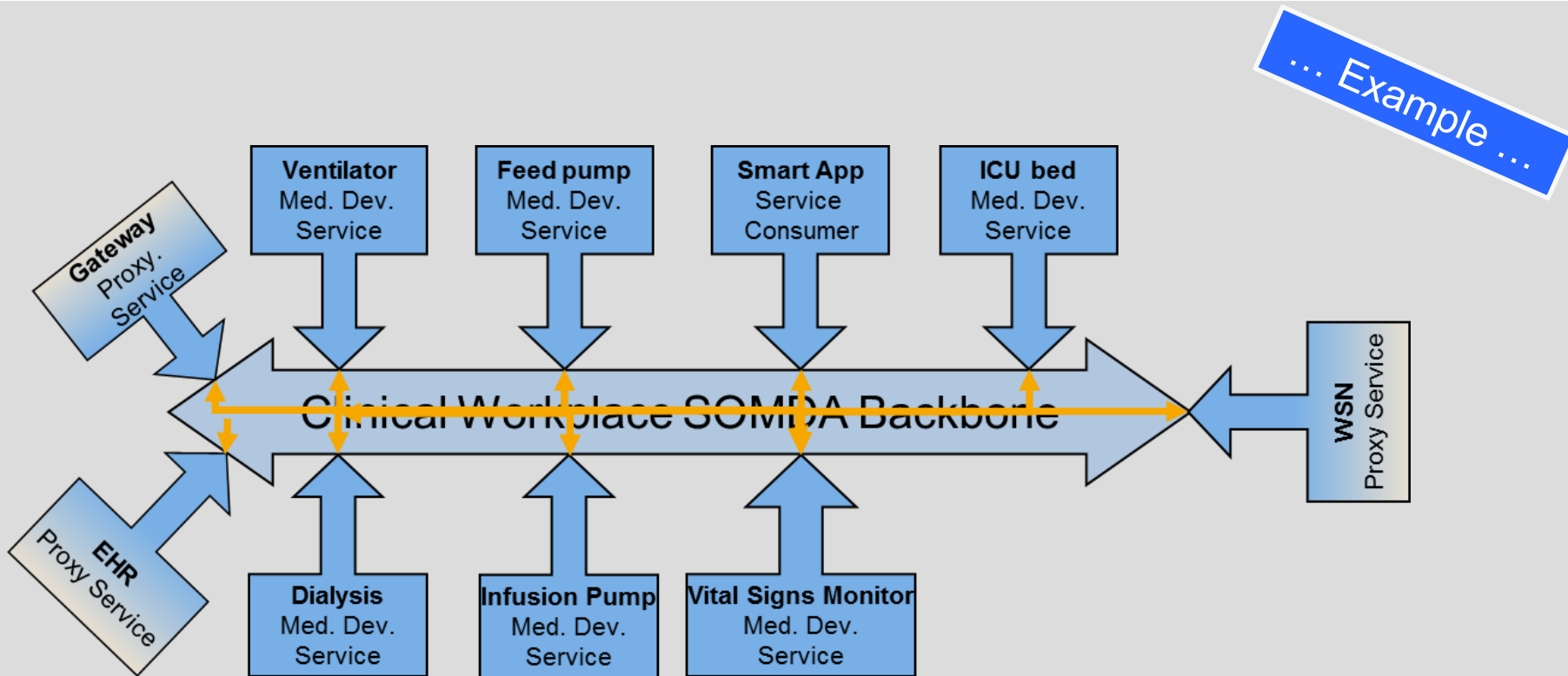
What is it?

The concept of a **clinical workplace service-oriented medical device architecture** transfers the concept of a **service-oriented architecture** to the domain of **medical cyber physical systems for one clinical workplace.**



Clinical Workplace SOMDA

What is it?



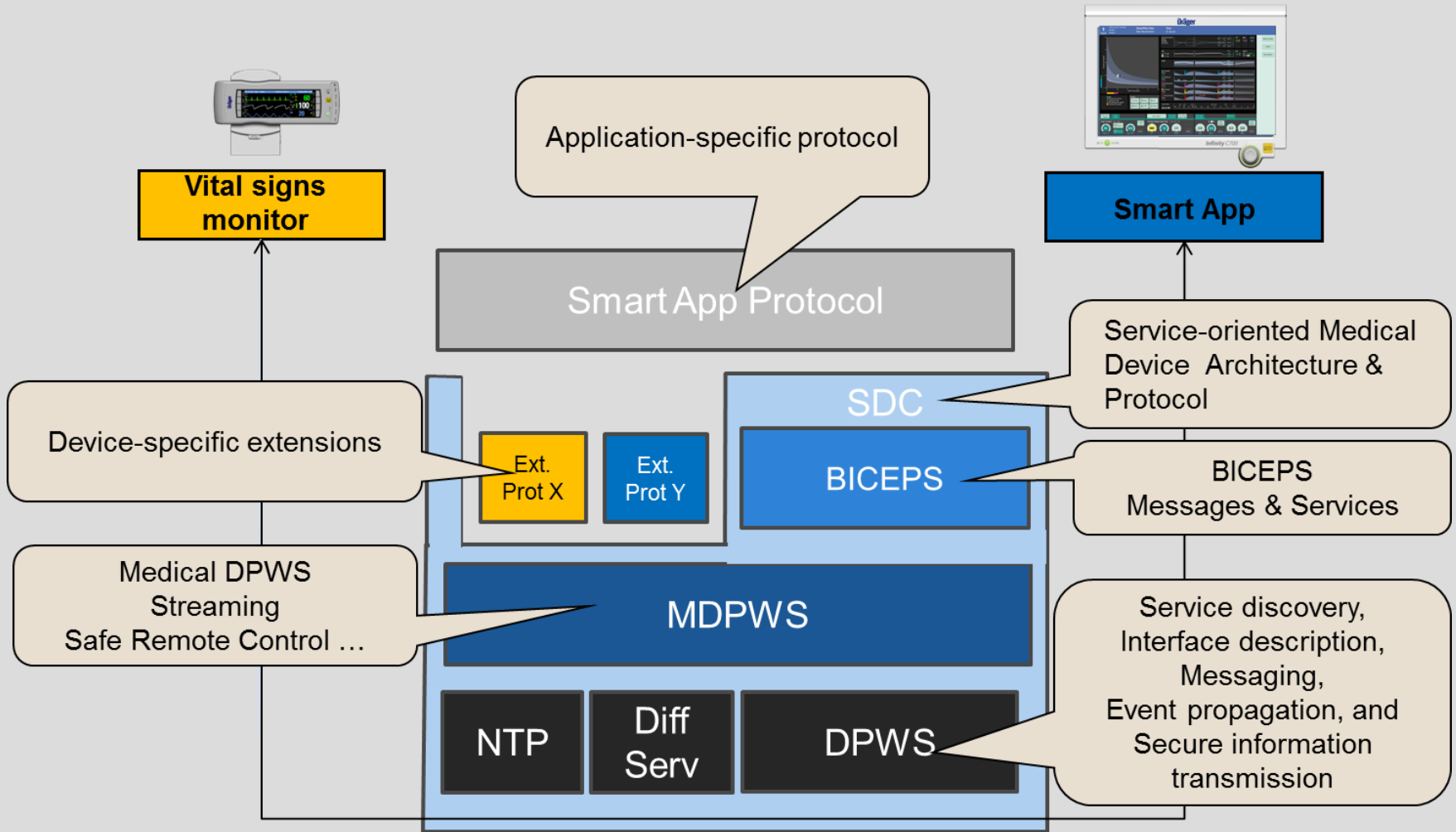
Conceptual view of a SOMDA for a clinical workplace

Concept of a clinical workplace SOMDA does not make any assumptions of the underlying network topology.

-
1. Introduction
 2. Clinical Workplace SOMDA
 - 3. Protocol Stack**
 4. Results
 5. Discussion
-
-

Protocol Stack

Proposed Protocol Stack



Protocol Stack

Medical Device Profile for Web Services

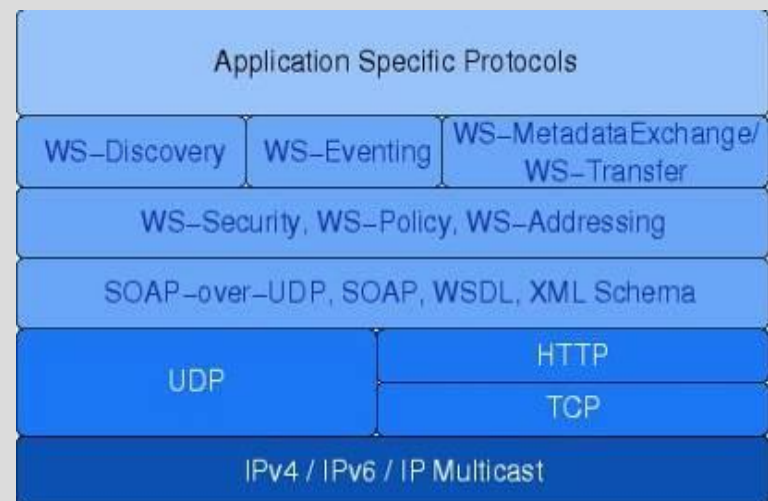
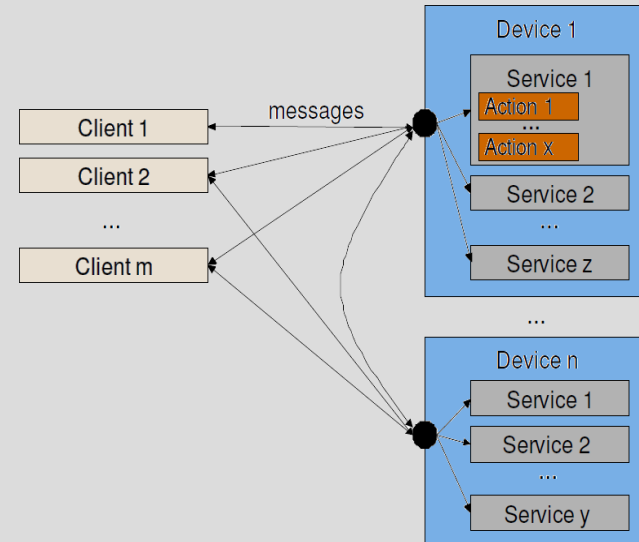
■ DPWS:2009* is the core of MDPWS

- OASIS standard (since 07/2009)
- Utilizes a subset of the WS-* standard
- Covers
 - Service discovery,
 - Interface description,
 - Messaging,
 - Event propagation, and
 - Secure information transmission
- Designed for resource-constrained devices

■ MDPWS

- Added some missing parts e.g. safe transmission of control requests

*See <https://www.oasis-open.org/committees/ws-dd/>



- A communication middleware for remote control should ensure **single fault safety**.
- Definitions from IEC 60601-1

Single Fault Safety

“characteristic of ME equipment or its parts whereby it remains free of unacceptable risk during its expected service life under single fault condition”

Single Fault Condition

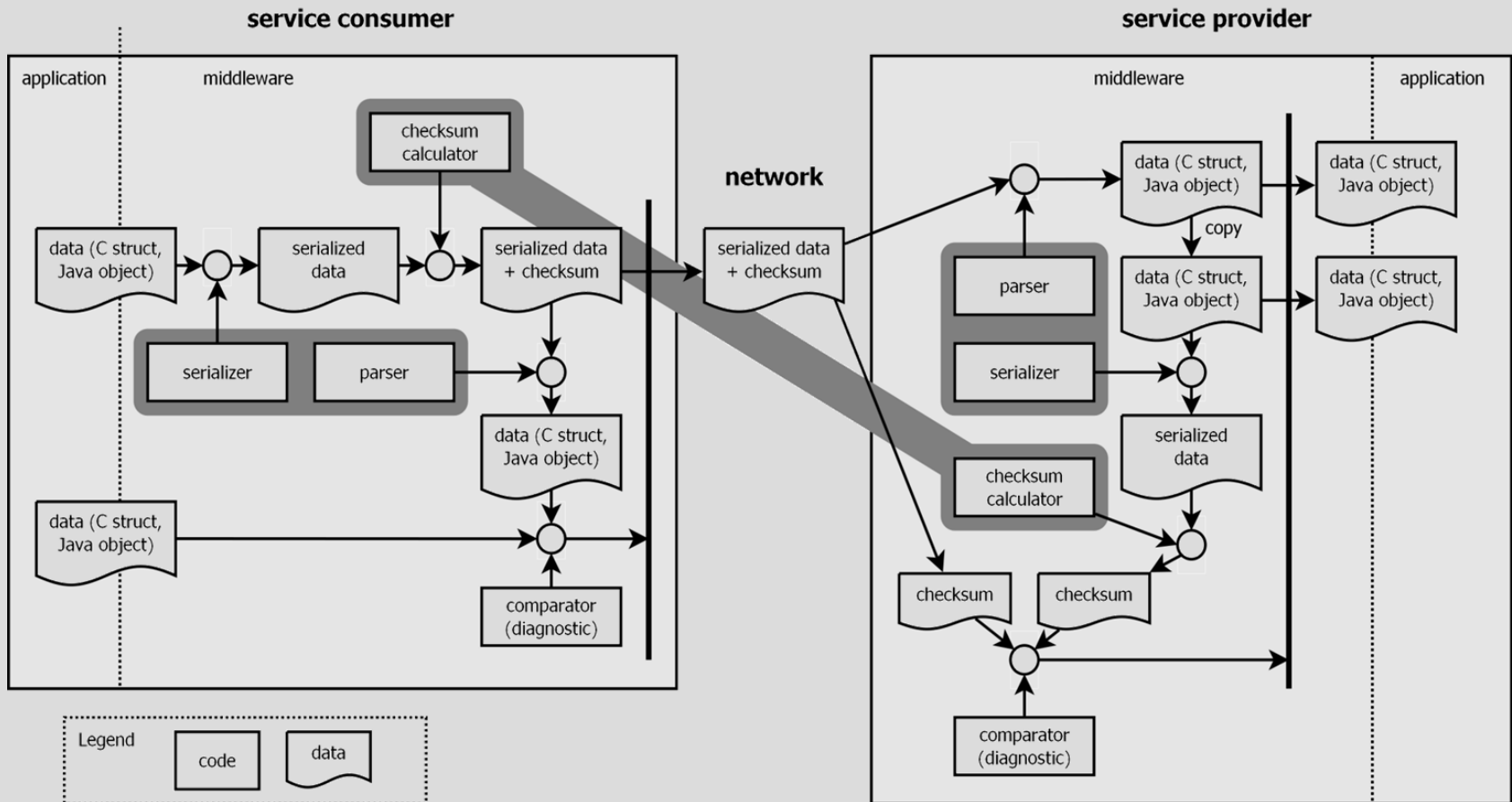
“condition in which a single means for reducing a risk is defective or a single abnormal condition is present”

- utilization of a dual channel architecture



Implement a protocol that allows a dual channel transmission on top of the DPWS protocol stack

The service provider detects a failure, e.g., by means of an invalid checksum.



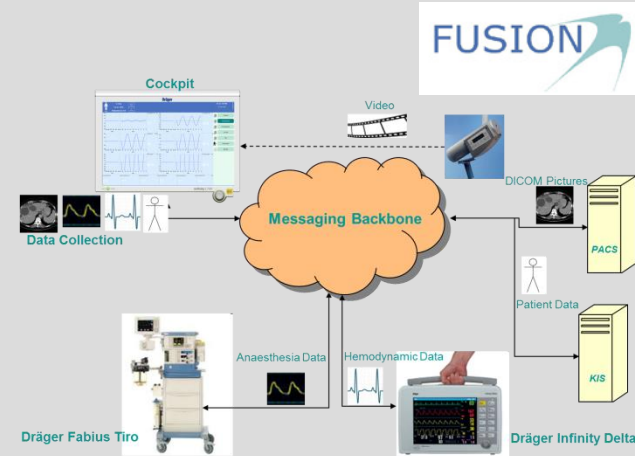
-
1. Introduction
 2. Clinical Workplace SOMDA
 3. Protocol Stack
 - 4. Results**
 5. Discussion
-
-

Results

Demonstrators



OR.NET, Berlin, 2015-04-15



Demonstrator, 2009



DOOP Demonstrator, Lübeck, 2013-12-11



Demonstrator, 2011






DOOP Demonstrator, Lübeck, 2013-12-11, watch on youtube: <http://goo.gl/OJ3Gla>

-
1. Introduction
 2. Clinical Workplace SOMDA
 3. Protocol Stack
 4. Results
 - 5. Discussion**
-
-




Discussion Summary

Functional

Plug'n Play

- Discovery and Binding 
- Device capability description at runtime 
- Openness 

Communication (1-1, 1-n, n-n)

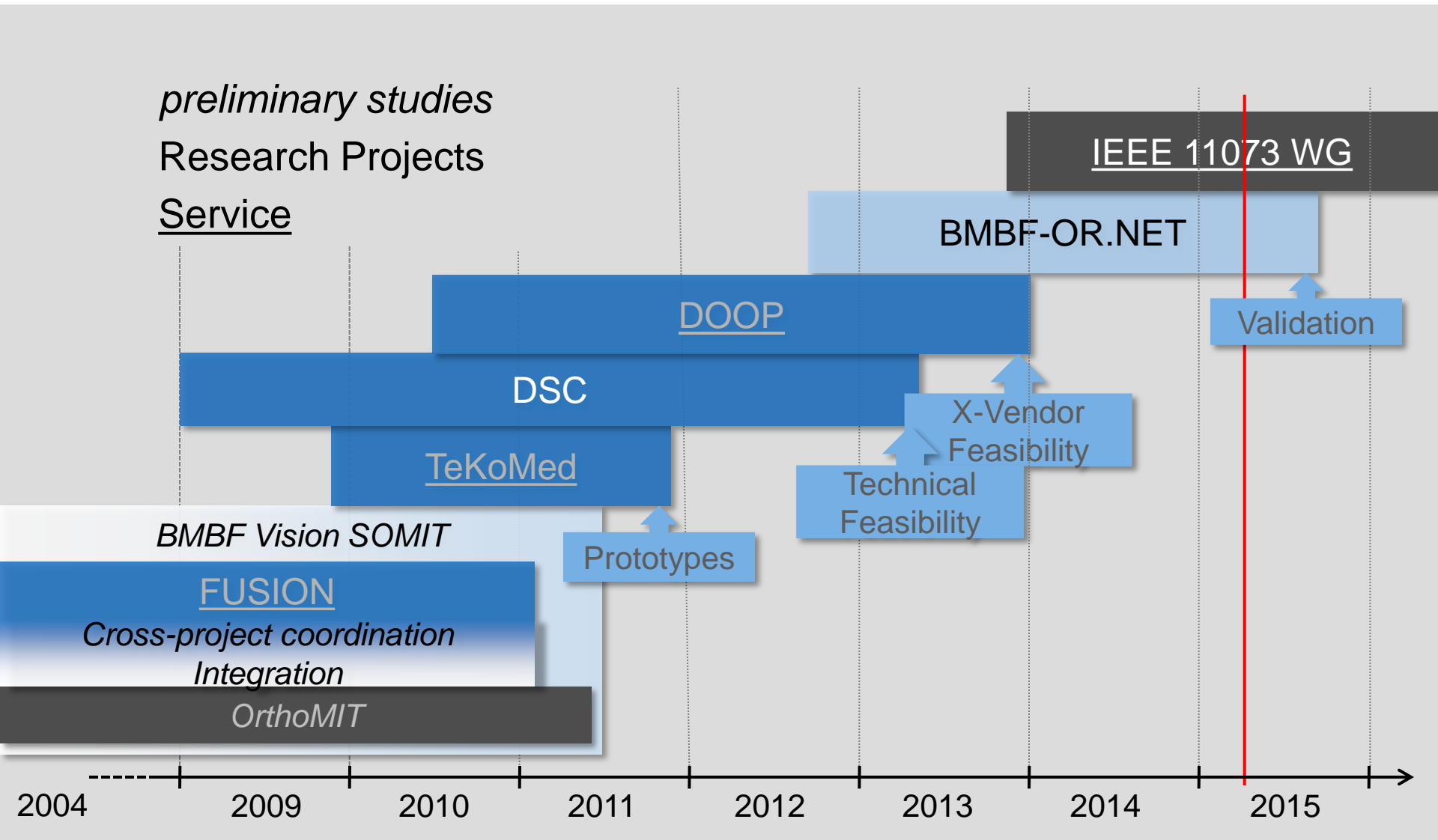
- Event Notification 
- Data reporting 
- External control 

Non-Functional

- Risk Management 
- Safe communication 
- Access control 
- Trust establishment between participants 
- Privacy of patient-related data 
- Latency in milliseconds range 

Protocol stack meets the requirements ...

Discussion History & Outlook



Discussion

IEEE 11073 Standard



P11073-10702	P11073-20701	P11073-20702
Submitter Email: stefan.schlichting@draeger.com Type of Project: New IEEE Standard PAR Request Date: 19-Oct-2014 PAR Approval Date: 10-Dec-2014 PAR Expiration Date: 31-Dec-2018 Status: PAR for a New IEEE Standard	Submitter Email: stefan.schlichting@draeger.com Type of Project: New IEEE Standard PAR Request Date: 19-Oct-2014 PAR Approval Date: 10-Dec-2014 PAR Expiration Date: 31-Dec-2018 Status: PAR for a New IEEE Standard	Submitter Email: stefan.schlichting@draeger.com Type of Project: New IEEE Standard PAR Request Date: 19-Oct-2014 PAR Approval Date: 10-Dec-2014 PAR Expiration Date: 31-Dec-2018 Status: PAR for a New IEEE Standard
1.1 Project Number: P11073-10702 1.2 Type of Document: Standard 1.3 Life Cycle: Full Use	1.1 Project Number: P11073-20701 1.2 Type of Document: Standard 1.3 Life Cycle: Full Use	1.1 Project Number: P11073-20702 1.2 Type of Document: Standard 1.3 Life Cycle: Full Use
2.1 Title: Standard for Domain Information & Service	2.1 Title: Standard for Service-Oriented Medical Device	2.1 Title: Standard for Medical Devices Communication
3.1 Working Group: Upper_Layer (EMB/11073/UL) Contact Information for Working Group Chair Name: Jan Wittenber Email Address: jan.wittenber@gmail.com Phone: 978-494-2439 Contact Information for Working Group Vice-Chair: None	3.1 Working Group: Upper_Layer (EMB/11073/UL) Contact Information for Working Group Chair Name: Jan Wittenber Email Address: jan.wittenber@gmail.com Phone: 978-494-2439 Contact Information for Working Group Vice-Chair: None	3.1 Working Group: Upper_Layer (EMB/11073/UL) Contact Information for Working Group Chair Name: Jan Wittenber Email Address: jan.wittenber@gmail.com Phone: 978-494-2439 Contact Information for Working Group Vice-Chair: None
3.2 Sponsoring Society and Committee: IEEE Engineering Society (EMB/11073)	3.2 Sponsoring Society and Committee: IEEE Engineering Society (EMB/11073)	3.2 Sponsoring Society and Committee: IEEE Engineering Society (EMB/11073)

11073 standard projects

Discussion openSDC

sourceforge.net/projects/opensdc/

sourceforge Search Browse Enterprise Blog Help

SOLUTION CENTERS Go Parallel HTML5 Smarter IT Resources Newsletters

Home / Browse / Communications / Communications / openSDC

openSDC Beta

OpenSDC facilitates development of dist. systems of medical devices.
Brought to you by: klotzt, schlich09, steph96

Summary Files Reviews Support Wiki Tickets Discussion BICEPS MDPWS JDPWS

★ Add a Review
↓ 24 Downloads (This Week)
📅 Last Update: 3 hours ago

Download
openSDC-1.0-BETA_01-complete.jar

Tweet 0 +1 0 Gefällt mir Browse All Files

Description

The openSDC libraries are communication library that facilitate the development of distributed systems of medical devices in high-acuity environments.

OpenSDC has been developed in an Dräger-internal technology project called "Device & System Connectivity" that had the goal to meet increasing demand for medical device interoperability in an Integrated Clinical Environment (ICE). An ICE is a distributed system of medical devices for one clinical workplace that may have an external interface to other systems. ASTM F2761-1:2009 describes the components that are required for safe and effective "Plug & Play" operation of an ICE in high-acuity environments.

The project had the objective to develop an efficient, future-proof architecture, protocol stack, and middleware that satisfies the derived requirements and facilitates the implementation of the concept of an ICE.

... Feedback requested ...

... and you can evaluate it yourself by downloading the **open-source reference implementation** from sourceforge

<https://sourceforge.net/projects/opensdc>

**Thank you for your
attention.**

Contact

**Dr. Stefan Schlichting
Research Unit, Drägerwerk AG
stefan.schlichting@draeger.com**