

# An Approach Towards a Flexible Network Architecture

**Euroview 2009**  
**27.- 28. July Würzburg Germany**

**B. Reuther, A. Siddiqui,  
D. Schwerdel, P. Müller**  
University of Kaiserslautern  
ICSY Lab

In cooperation with  
**University of Karlsruhe (M. Zitterbart)**  
**University of Munich (J. Eberspächer)**

SPONSORED BY THE



**Federal Ministry  
of Education  
and Research**

# Overview

---

- ▶ Goal
- ▶ Sketch of approach
- ▶ Framework for Processing Workflows
- ▶ Selection & Composition for Workflow Definition
- ▶ Discussion

# Goal

---

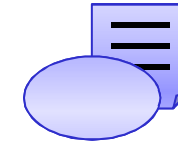
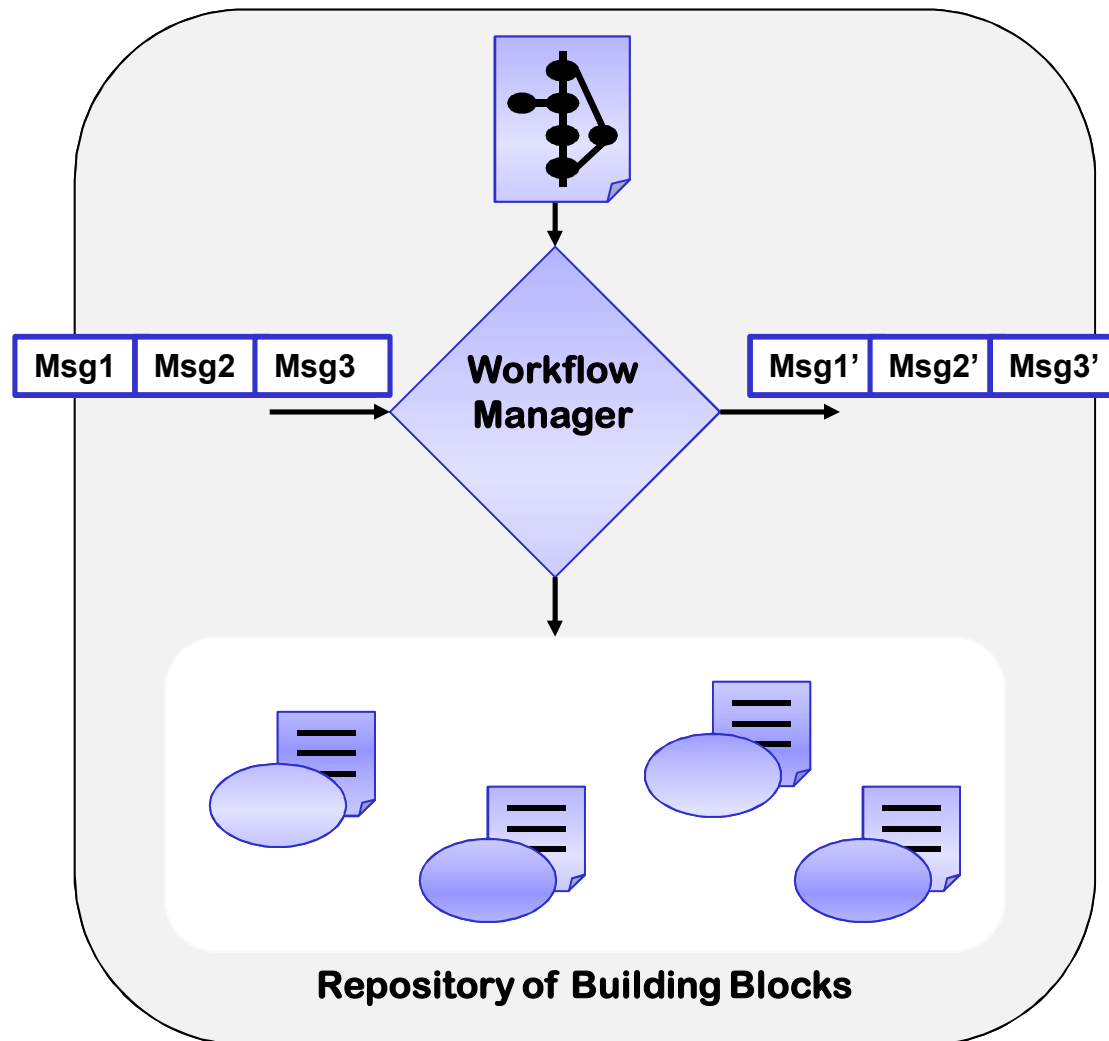
- ▶ Considered Problem: it is hard to integrate new functionality into the current Internet
  - The problem is not limited to a specific protocol
  - It is an architectural issue!
  
- ▶ Goal: an architecture supporting change of functionality
  - Minimize coordination overhead for the process of changing functionality
  - Automate necessary coordination
  - Support decentralized evolution
  - Decide common fundamental protocols on definition (and not technical constraints)

# Approach

---

- ▶ Approach: learn from software engineering, foster loose coupling of functionality
  
- ▶ Encapsulate functionality in building blocks (BB)
  - Micro-protocols (e.g. flow-control, retransmission or a video codec)
  - Other functionality (e.g. monitoring or lookup services)
  
- ▶ Properties of building blocks
  - Generic and well-defined interfaces
  - No direct references to other building blocks
  - Control data of different building blocks is separated
  
- ▶ Organize interactions of building blocks in order to offer complex services described by a workflow (or protocol-graph)
  - Framework for processing workflows (per network node)
  - Selection & Composition for workflow definition (per data flow)

# Framework for Processing Workflows



**Building block and its Description (defined per node)**



**Workflow description (created / signaled per flow)**

**Msg1**

**Data for a specific BB (exchanged when needed)**

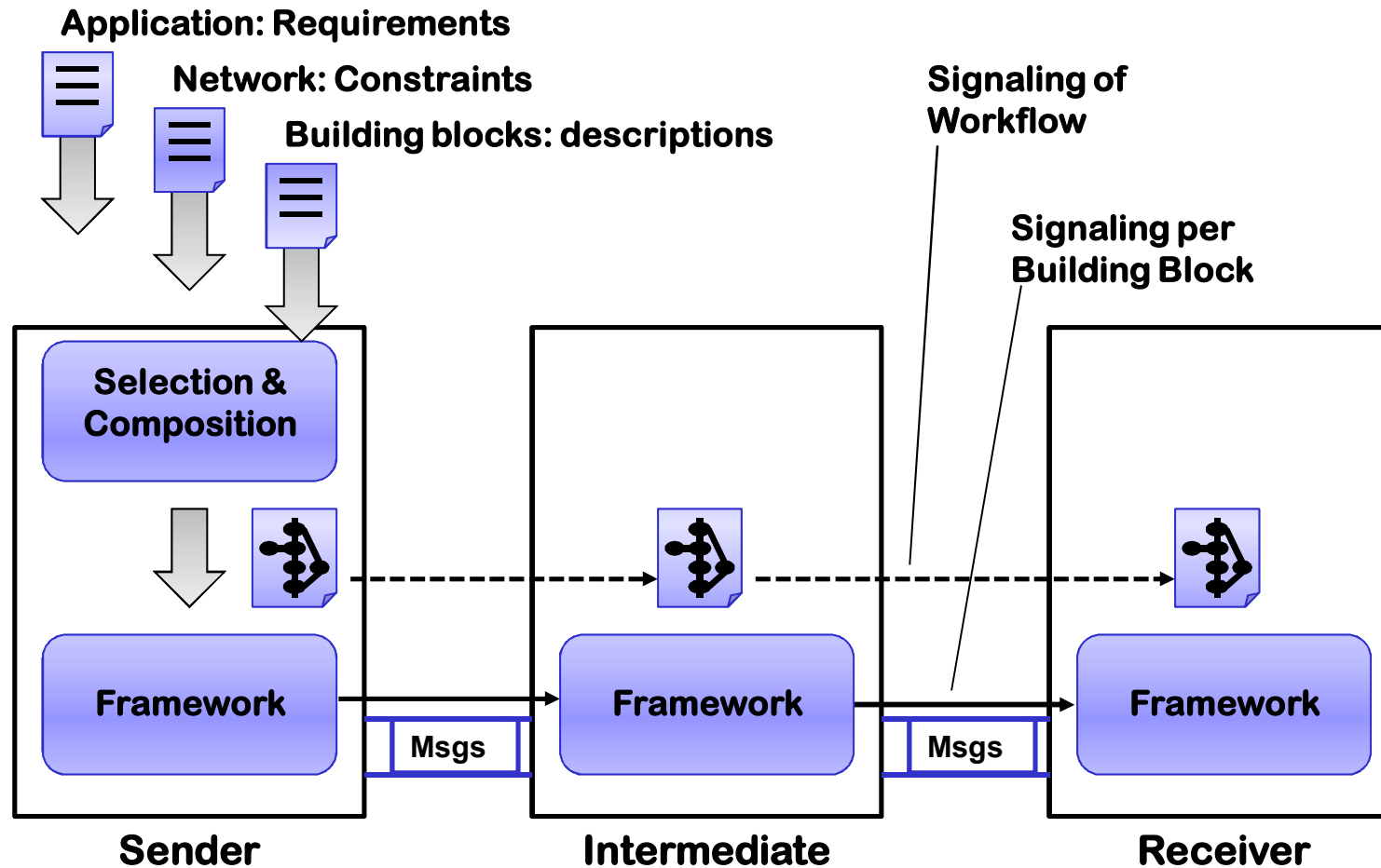
# Framework for Processing Workflows

---

- ▶ Goal: support loose coupling of building blocks
- ▶ Process a workflow
  - Basically: (sequential) call of build blocks, providing and receiving a message (control data)
  - Control-Flow
    - Support branches (e.g. on error)
    - Trigger activity by events & timers
  - Data-Flow
    - Exchange of mandatory or optional I/O values (e.g. for routing, Input: addresses, Output: outgoing port)
    - Provide access to other messages (e.g. for calculating hash values)
- ▶ Provide infrastructure
  - Shared data structure for exchanging values
  - Event handling
  - Timer
  - Session management
  - Management of repository for building blocks



# Selection & Composition for Workflow Definition



# Selection & Composition for Workflow Definition

---

- ▶ Goal: foster / simplify utilization of new building blocks
- ▶ A workflow is defined locally (e.g. by initiator of communication) and signaled to other participants
  - Utilization of building blocks is independent of a third party
  - Method for defining workflows is not defined
    - Select one of few predefined workflows
    - Sophisticated selection & composition process, involving negotiations and current network status
- ▶ Propose automatic selection & composition
  - Utilize new building blocks as soon as they are available
  - Handle huge number of possible protocol combinations
- ▶ Workflow signaling
  - In-band within stream of messages (necessary for “connection-less” communication)
    - Sequence of messages, describe the basic sequential calls of building blocks
  - Out-of-band or during connection setup



# Discussion

---

- ▶ Risk of the framework approach
  - Introduces new complexity
    - More descriptions required
    - Causes processing overhead compared to directly interacting building blocks
  - Reduces complexity for changing functionality
- ▶ Fostering heterogeneous nodes (according to functionality available) raises new management issues
  - Determine available building blocks within a large infrastructure
- ▶ Utilize testbed
  - Especially for emulating many (different) network nodes
  - Gain experience with management of heterogeneous infrastructures

# Questions Please

---

