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# Low Degree of Separation Does Not Guarantee Easy Coordination

**Zane Galviņa and Darja Šmite**

**Euromicro 2012  |  Turkey**

# Context



## Complexities of distributed work
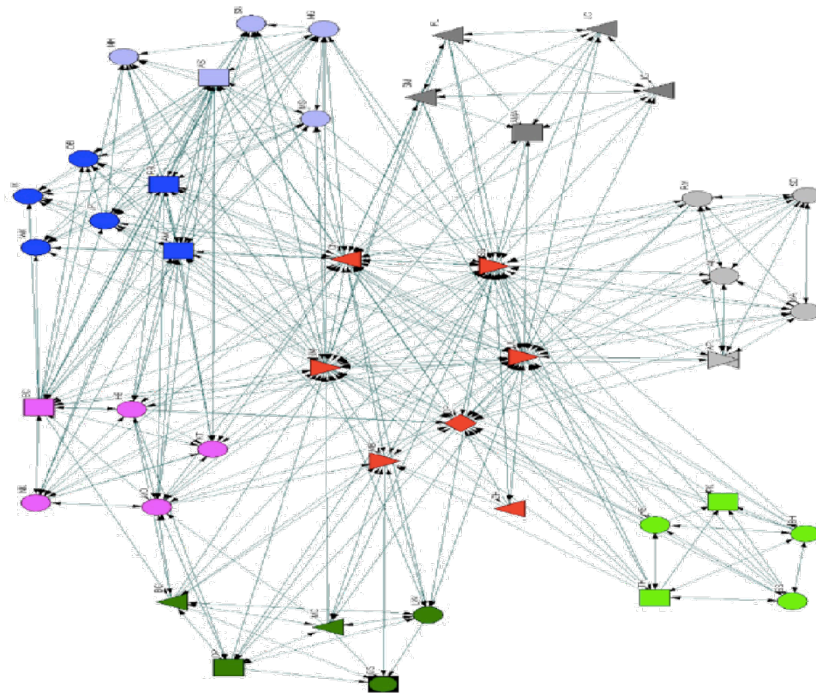


(Siemens Global Studio Project – 05/06; I.Richardson)

## Collaboration models

| | | Same organization | Different organization |
|---|---|---|---|
| **Same country** | | Onshore insourcing | **Onshore outsourcing** |
| **Different country** | | Offshore insourcing | Offshore outsourcing |

# Context

## Traditional coordination models

- Coordination is the act of coordinating activities toward a common goal
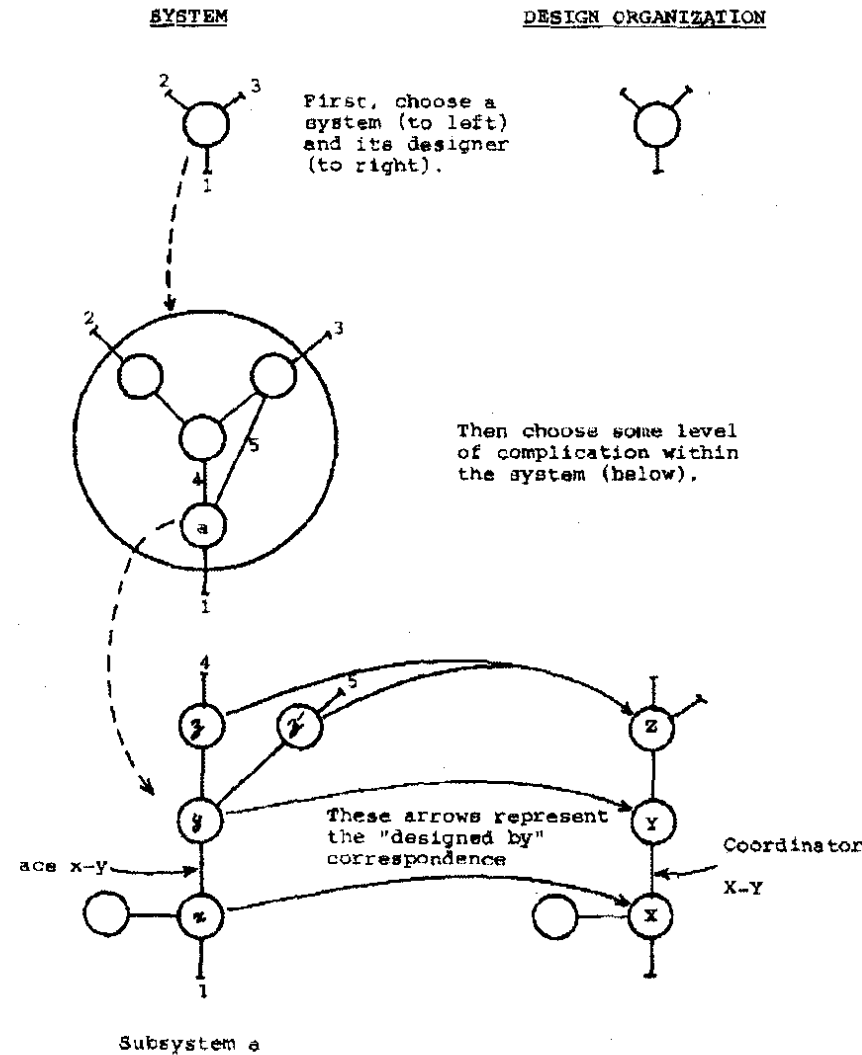
## Modern coordination models

- Coordination is the act of coordinating dependencies between activities toward a common goal
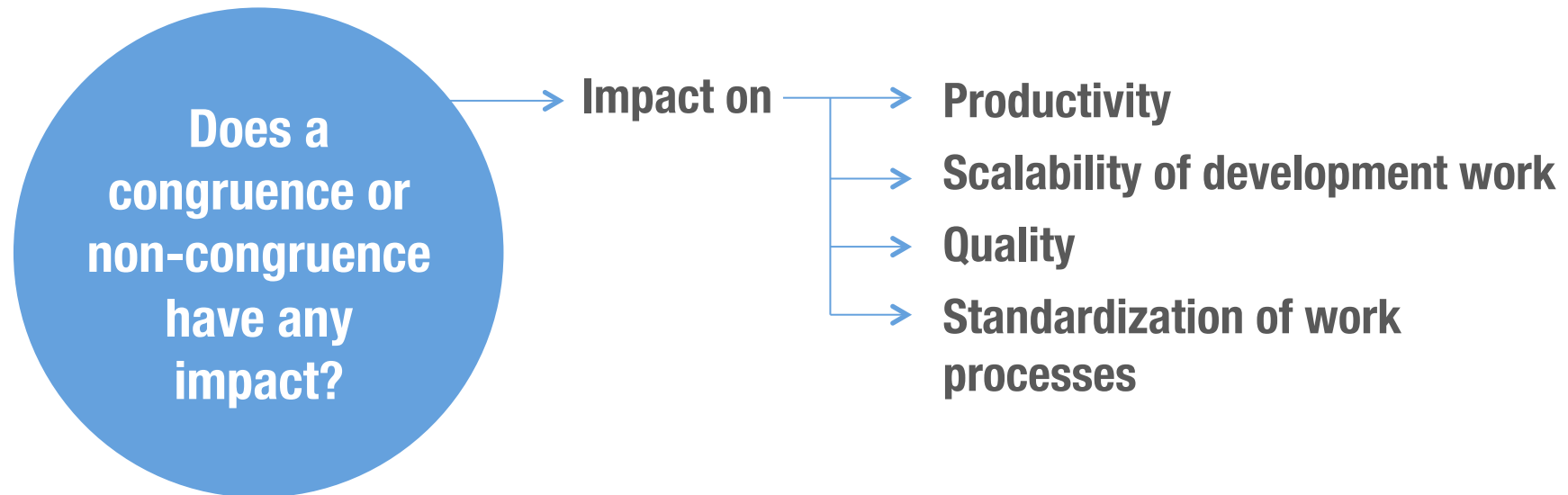
# System Design Organization



**HOW DO COMMITTEES INVENT?**
by MELVIN E. CONWAY

**Organization that designs systems are constrained to produce designs which are copies of the communication structures of these organizations**

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# Related work

**Does a congruence or non-congruence have any impact?**

Impact on
- **Productivity**
- **Scalability of development work**
- **Quality**
- **Standardization of work processes**

# Effects of non-congruence

- Misalignment often has a negative impact on productivity and quality
(by Herbsleb and Grinter)

- Architectural dependencies can be used to structure tasks, and distribute, allocate, and coordinate work across teams and locations so that communication, coordination, and synchronization needs are minimized and communication breakdowns reduced
(by Herbsleb and Grinter, Cataldo et al. Herbsleb and Mockus)

# Research questions

**RQ1**    How unclear organizational structure affects task flows in a highly distributed software project?
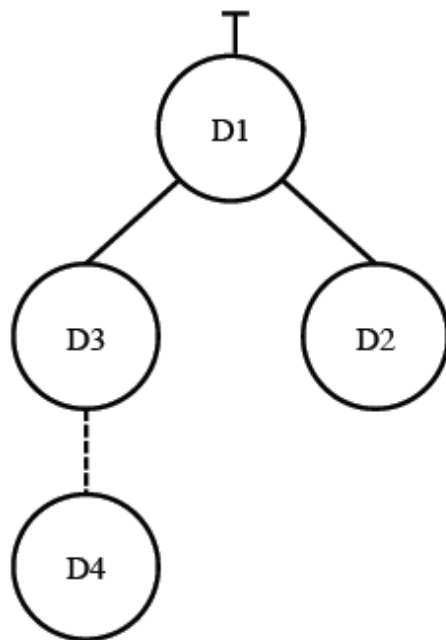
**RQ2**    What is the mean time of cross-organizational task coordination delays?

# Study overview

Empirical context:
Collaboration between four Latvian software organizations

D1: Prime contractor
Customers acquired the system development from D1

D2 and D3: Direct sub-contractors
D1 sub-contracted parts of the system development to D2 and D3

D4: Hidden sub-contractor
D3 sub-contracted parts of their work to D4;
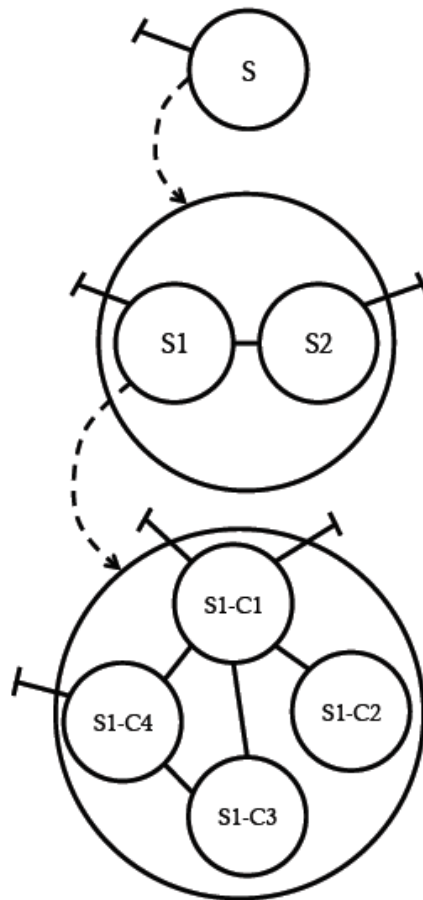the relationship is hidden from the other organizations

Research method: Participant observation

# Data collection

| | Artifacts collected | Observations |
|---|---|---|
| **Requirements analysis and design** | • Project Management Plan<br>• Software Requirement Specification<br>• Software Design Specification<br>• Problem Reports | • Interviews with the users<br>• Weekly meetings with D4 and D3<br>• Participation in two meetings among D1, D3, D4 to finalize the requirements and design documentation |
| **Development** | • Problem Reports<br>• 111 Jira task assignments<br>• 38 emails with task assignments | • Participation in the virtual weekly meetings at D4<br>• Participation in demo session at D1 |
| **Testing** | • Problem Reports | • Participation in the weekly virtual meetings with D4<br>• Participation in demo sessions regarding fixes |

# Product structure



**System level**
The system has external interface

**Sub-system level**
The system consists of two interrelated sub-systems (1 and 2). Both sub-systems have external interfaces

**Component level**
Sub-system 1 consists of four components. Some of these components are interrelated. External and internal interfaces with sub-system 2 exist through component 1

# Project failure

- The project started in the beginning of 2011
- Planned to finish by January 2012
- The project is still not finalized!!!
- Delays in completion of sub-system 1
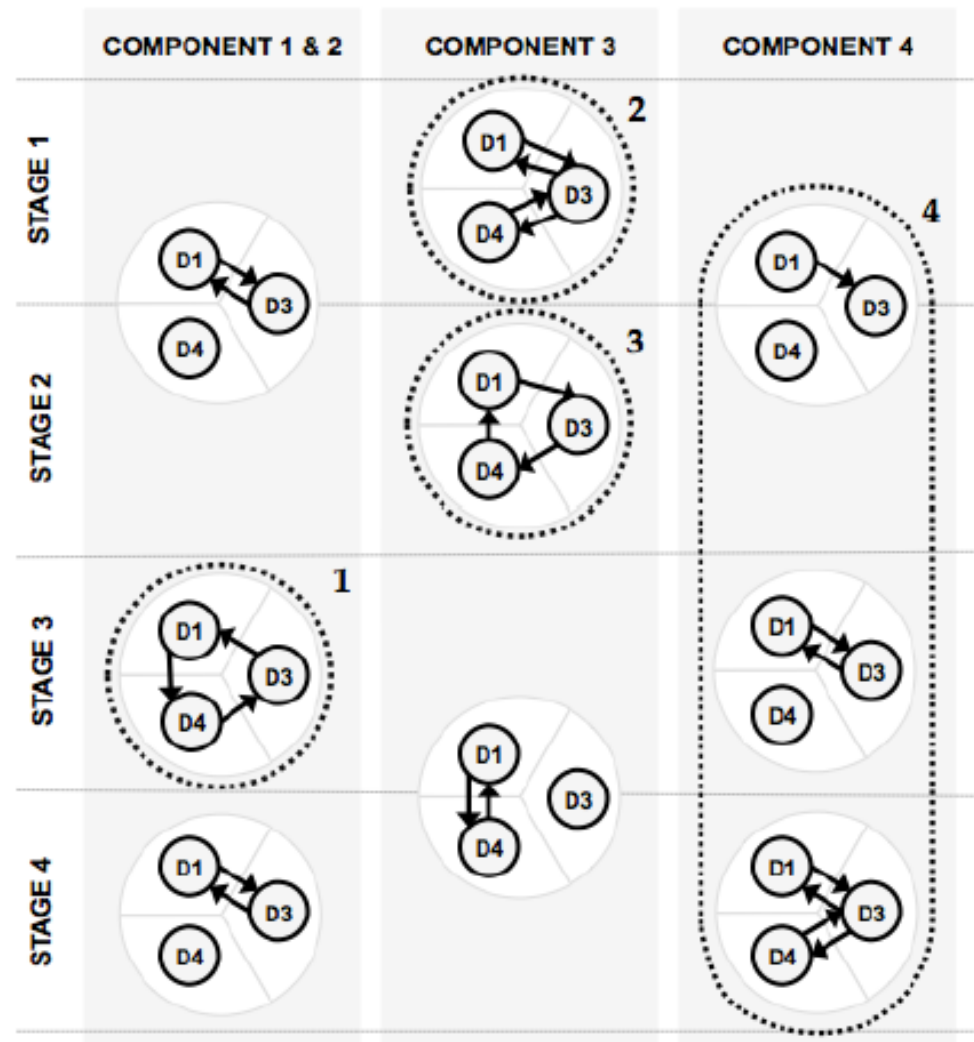
# Task allocation
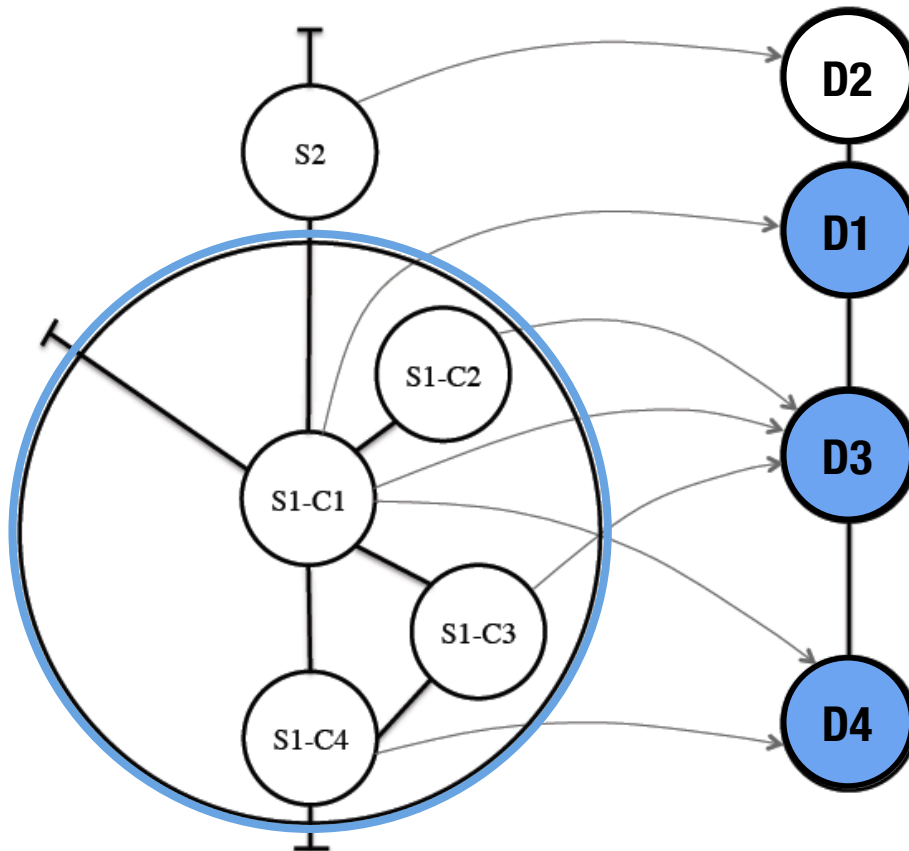


Misalignment of the product structure and project organization

Expected coordination complexity and inefficiency involving the hidden organization

Exploratory focus:
**coordination flows**

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# Findings: coordination flows



*Dotted lines indicate problematic flows*

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# Stages

- **Stage 1:**
  - Work assigned by D1 to D3 is further forwarded to D4
  - D4 does not have an account in Jira and tasks are sent via email
- **Stage 2:**
  - D4 gained access to Jira
  - D4 employees were acknowledged as official participants
  - Roles and responsibilities between D3 and D4 are still unclear
- **Stage 3:**
  - D1 started to reassign delayed tasks from D3 to D4
  - D4 affiliation is still hidden, coordination is based on assumptions
  - D3 realized that many of the reassigned tasks are false and 16 assignments were sent back to D1
- **Stage 4:**
  - Resulting coordination flows and initial task allocation do not match

# Coordination problems

- Evolution of coordination patterns changed dramatically and contained several problems:
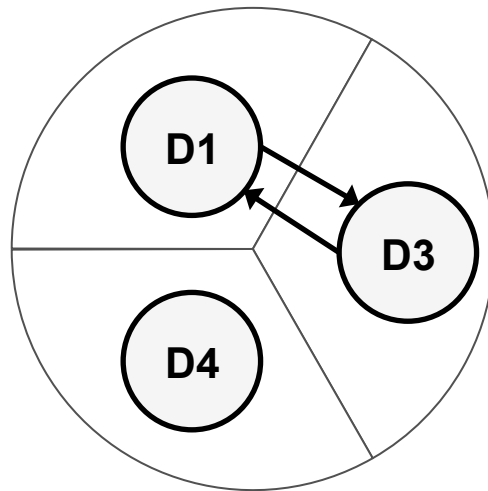  - Redundant flows
  - Cycles
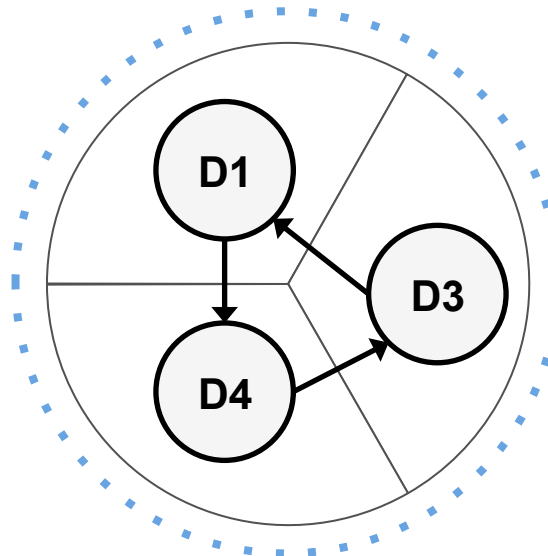  - Lack of necessary flows

# Coordination delays

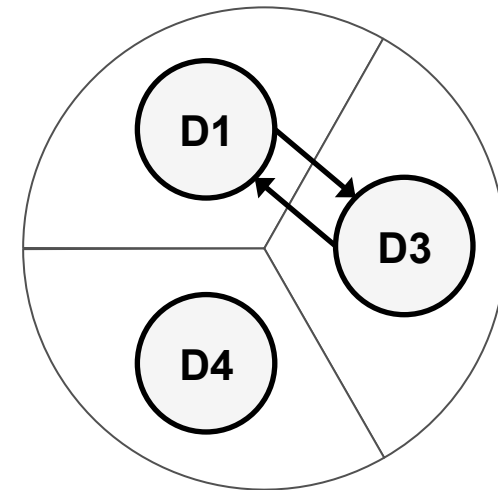| Flow 1 | | Flow 2 | | Flow 3 | | Flow 4 | |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Min | 15d 20h | Min | 3h | Min | 0h | Min | 138d 16h |
| Max | 138d 2h | Max | 104d 20h | Max | 74d 21h | Max | 184d 20h |
| Median | 40d 22h | Median | 18d 7h | Median | 18h | Median | 138d 16h |

# Components 1 and 2

*Unclear affiliation
between D3 and D4*



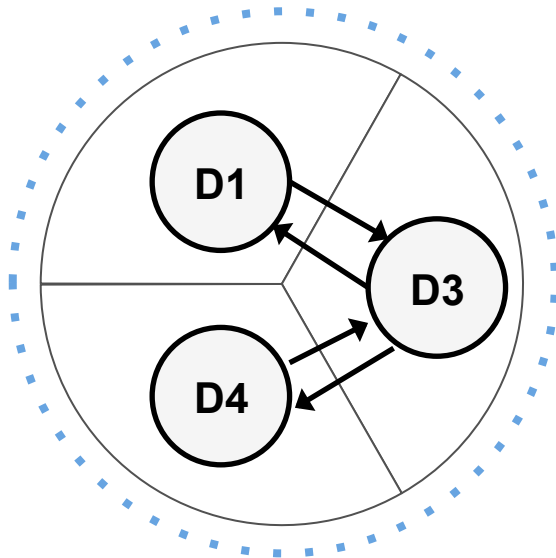**No delays**

**Coordination breakdown**

**No delays**

- 4 incorrectly assigned tasks
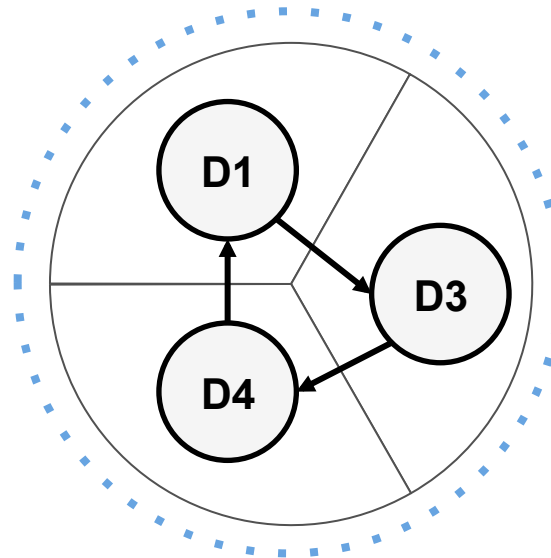- The loss reached median time of 40 days

# Components 3



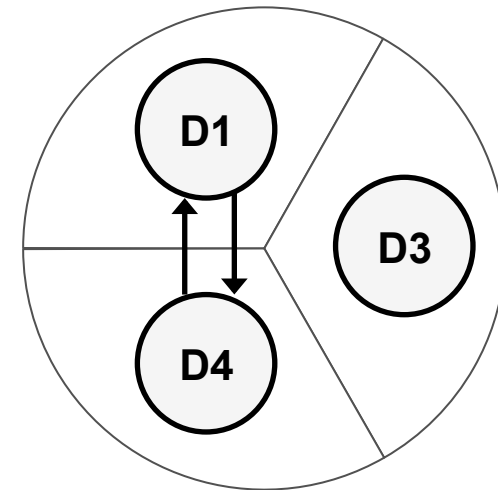*Jira is unavailable, tasks are tunneled through email*

*Access to Jira granted*

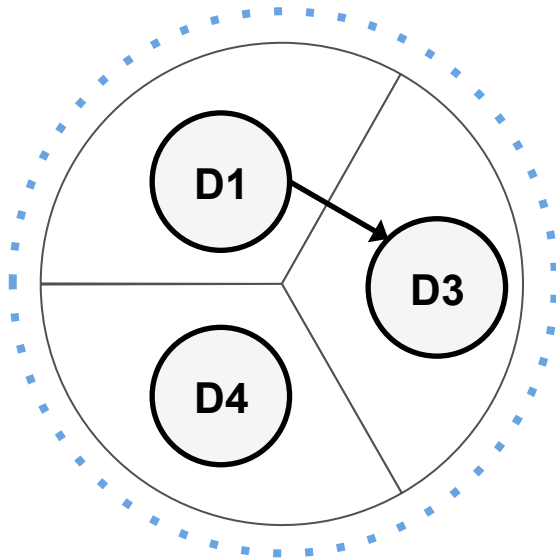**Coordination breakdown**

**Coordination breakdown**

**No delays**

- 35 task assignments
- Max delay reached 74 days 21 h

- 16 misallocated assignments
- Min time took 3 h, max - 104 days 20 h
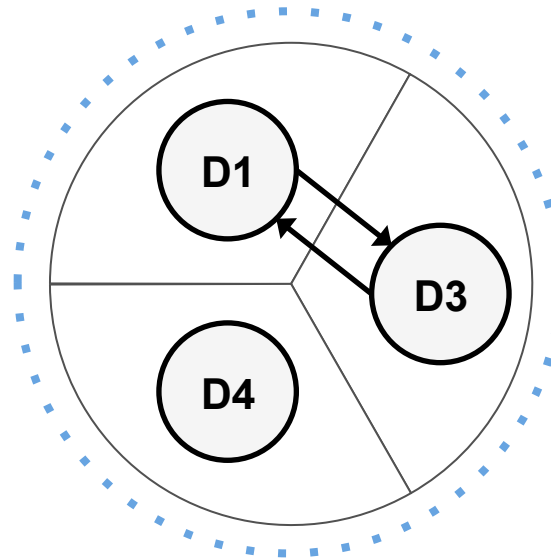
# Components 4: most complex

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*Poorly communicated responsibilities*
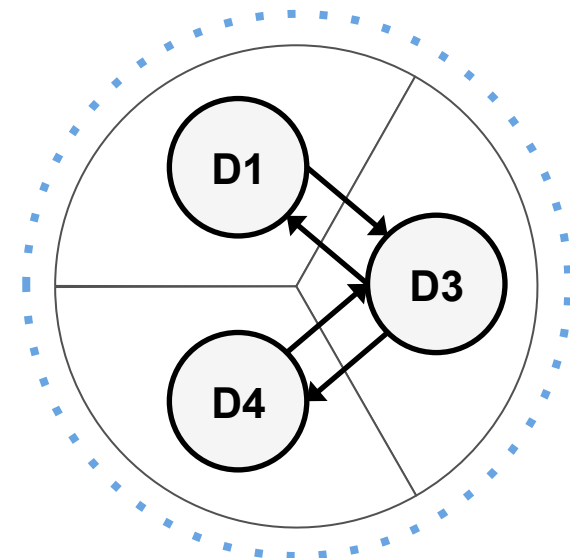
**Coordination breakdown**

- 16 task assignments
- Reassigned in the next stage

*Misunderstood responsibilities*

**Coordination breakdown**

- 16 misallocated assignments
- Reassigned to D4 at the next stage

**Coordination breakdown**

- 16 misallocated assignments
- Delay of 138 days 16 h (4 months+)

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# In retrospect

**Guidelines**

Clear component structure

Clear interfaces supported by communication and coordination mechanisms

Homomorphic principle for task allocation

# In retrospect

Clear component structure

Clear interfaces supported by communication and coordination mechanisms

Homomorphic principle for task allocation

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# Conclusions

- We expect that a task allocation strategy that is compliant with the Conway's proposition is more likely to minimize similar problems

- Onshore collaborations and thus low separation do not really ensure coordination success

- The true organizational structure might be hidden

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# Thank you for your attention!
# Questions?

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