Urban Data Platforms and Urban Critical Infrastructure

How can urban data platforms improve the resilience of urban critical infrastructure, and are they resilient themselves?

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emergenCITY

Urban Data Platforms and Resilience

Urban data platforms (UDP) are currently being launched in many cities as a part of their smart city strategies. They gather and provide access to data from various urban domains, including critical infrastructure.

We performed a survey about UDPs in Germany. Focusing on their potential for improving resilience of the city (**resilience through ICT**) and the resilience of the UDPs themselves (**resilience for ICT**),
our key findings were:

- UDP providers tend to focus on normal conditions rather than crisis
- critical infrastructure is often not covered
- lack of focus on crisis shows in the design of the UDPs as well

Enabling Situation Awareness

emergenCITY recognises situation awareness to be an important aspect during the entire course of a crisis. UDPs can be used to provide situational overview.

M. Hollick et al.: Emergencity: A Paradigm Shift Towards Resilient Digital Cities

In order to do this, **UDPs need to contain all relevant infrastructure data**.

In our survey, we see that in many UDPs, critical infrastructure is not yet represented.

Excourse: Infrastructure Outages during the 2021 Floods in Germany

Why representing critical infrastructure in the UDPs is important during crises can be illustrated on the example of the fatal 2021 floods in Germany.

Based on an **emergenCITY survey with 404 respondents directly affected by the flood**, we see that an infrastructure outage was experienced by at least a third of the respondents, regardless of the infrastructure type. Nearly 80% of the respondents experienced the outage of transport infrastructure.

Most respondents said the outages lasted multiple days or more than a week.

Making Interdependent Infrastructure Data Interoperable

Due to the interdependent nature of the critical infrastructures, interoperability through common data formats is necessary. In the emergenCITY Mission Knowledge Base, we adopted the NGSI-LD format for this purpose.

Besides developing converters between domain formats and NGSI-LD, we develop new data models in NGSI-LD in order to be able to capture interdependencies between critical infrastructures. Later, NGSI-LD will enable the usage of semantic reasoning in the infrastructure domain, e.g. to identify risks of cascading effects.

To test our UDP concept, we are developing an application that connects multiple domain simulators to emulate a real-world interdependent infrastructure system.

Bringing in Physical Systems

As a proof-of-concept, we have set up a test rig at the Chair of Fluid Systems, TU Darmstadt. The test rig contains typical water supply network components that can be represented using NGSI-LD-based smart data models.

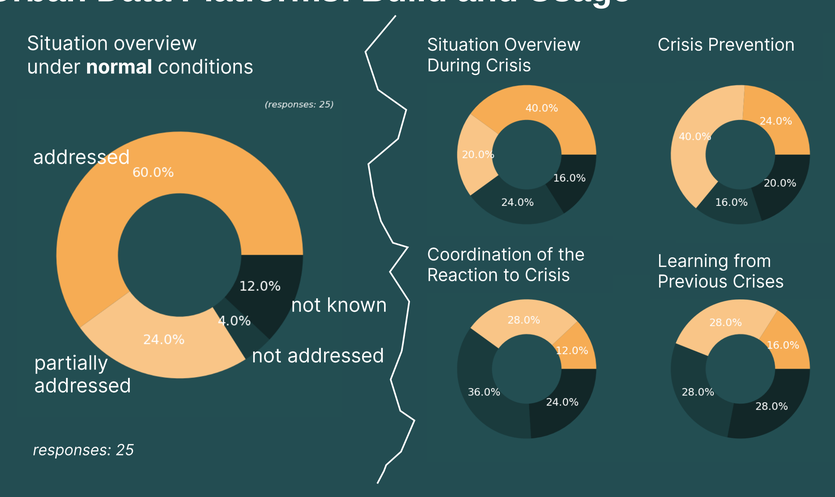
Using the test rig, a scenario will be set up to illustrate how data can be gathered in the UDP, visualised and used for further analysis, such as leakage detection.

Are Urban Data Platforms Themselves Resilient?

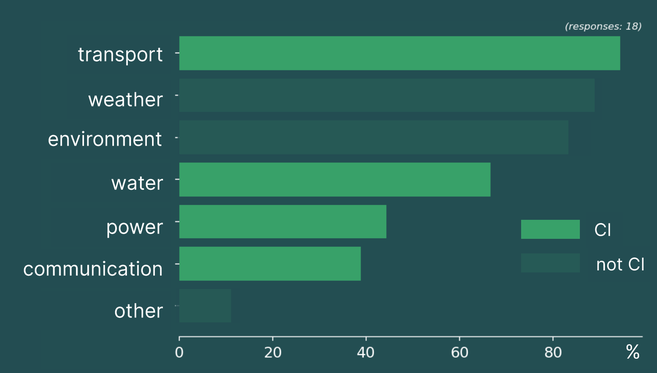
The lack of focus on resilience manifests also in the design of the UDPs. The UDP survey shows that about a third of the UDPs uses centralised setup, in which all data and services are localised on a single server, making it particularly vulnerable to failure of components. More than a half respondents say their UDP is a decentralized platform, operated on several servers which communicate with each other; data and services are distributed on these servers. Only 7% use federated data platform – it is operated on several servers, whereby the individual servers do not continuously synchronise with each other.

https://pad.emergencity.de/s/urban-data-platforms-desire
Scan the QR code to leave your feedback and get in touch.

Urban Data Platforms: Build and Usage



Data from which domains does your urban data platform track?

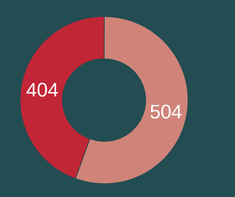


See more: Resilient Data Platforms for Smart Cities, ISNGI 2022

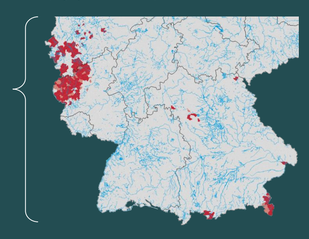
Excourse: 2021 Floods in Germany

See more: Infrastructure Failures and Coping Strategies of Citizens during the 2021 Flood in Germany, ISNGI 2022

Survey Participants:



Affected Regions in Germany (by postcode)



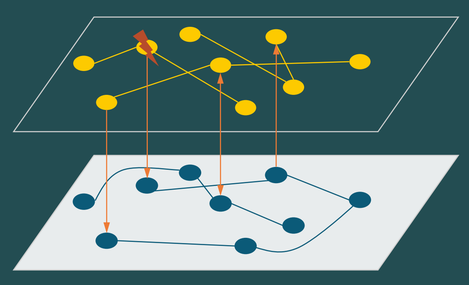
Infrastructure Outages

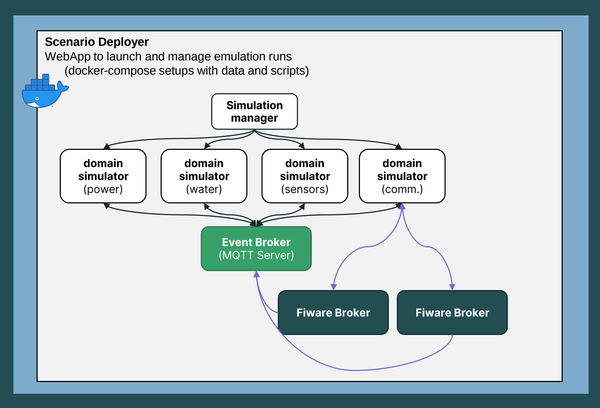
Power Outage	Mobile Network Outage	Water Outage	Internet Outage	Transport Network Outage	Sewage Outage
55%	47%	37%	56%	78%	36%

... of the respondenced experienced outage

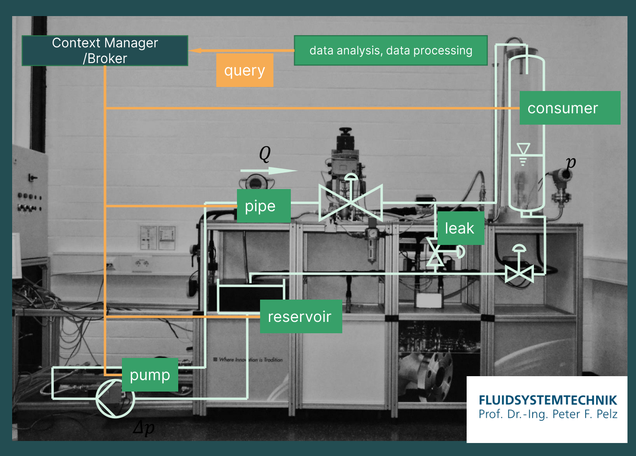
Interdependent Infrastructure Simulation in emergenCITY Mission Knowledge Base

https://www.emergencity.de/missions/kb/
Learn more about emergenCITY Mission Knowledge Base





Water Supply Test Rig as Proof-of-Concept



ngsi-ld

Next Generation Service Interface Linked Data


```
{
"@context": "https://raw.githubusercontent.com/
             smart-datamodels/dataModel.WaterDistributionManagementEPANET/
             master/context.jsonld"
"id": "urn:ngsi-ld:Pump:Pump_Frankfurter_Str ",
"type": "Pump",
"startsAt": {
            "type": "Relationship",
            "value": "urn:ngsi-ld:Reservoir:Reservoir_DA_Nord",
            },
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          "value": 100,
          }
  ...
}
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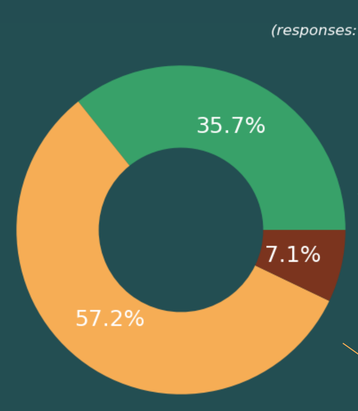
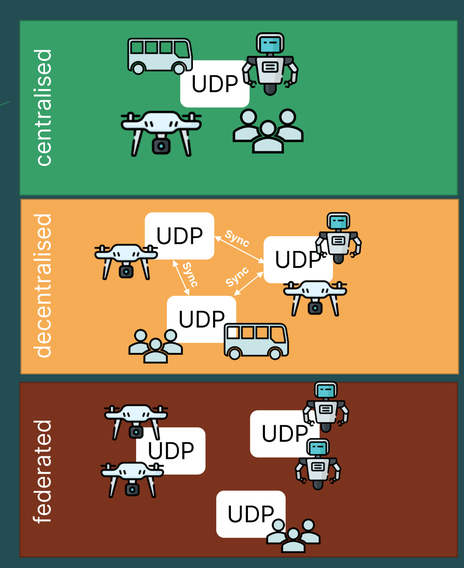
Urban Data Platform Setup





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