EPI Framework: A dynamic infrastructure to support health applications

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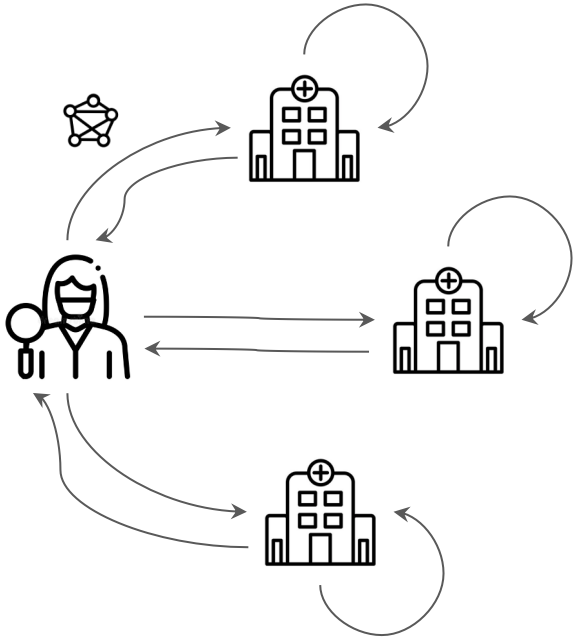
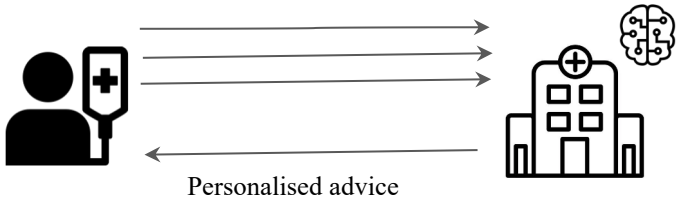
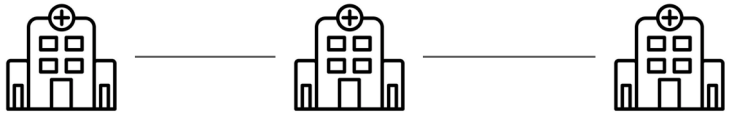
Towards personalised medicine





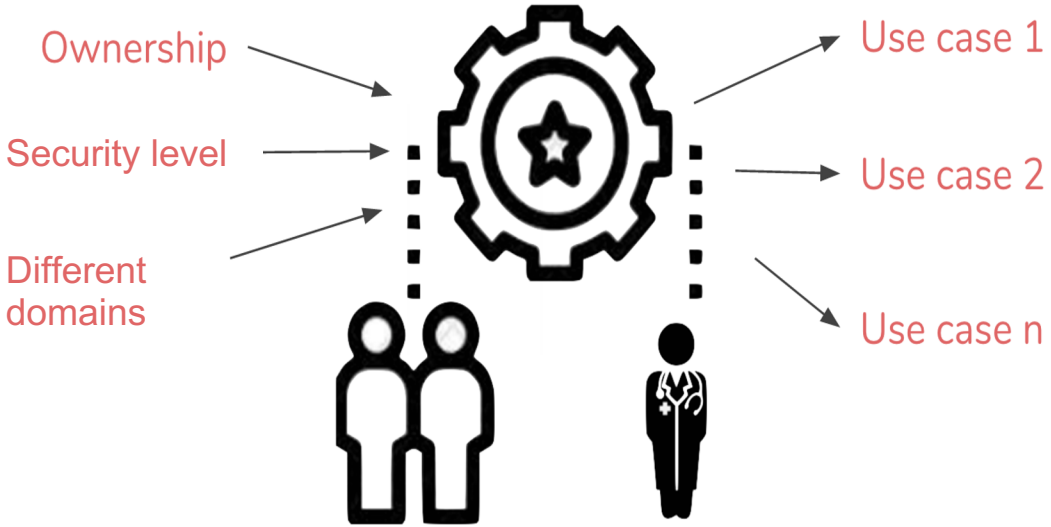
Personalised advice



Collaborate EHR of distributed datasets

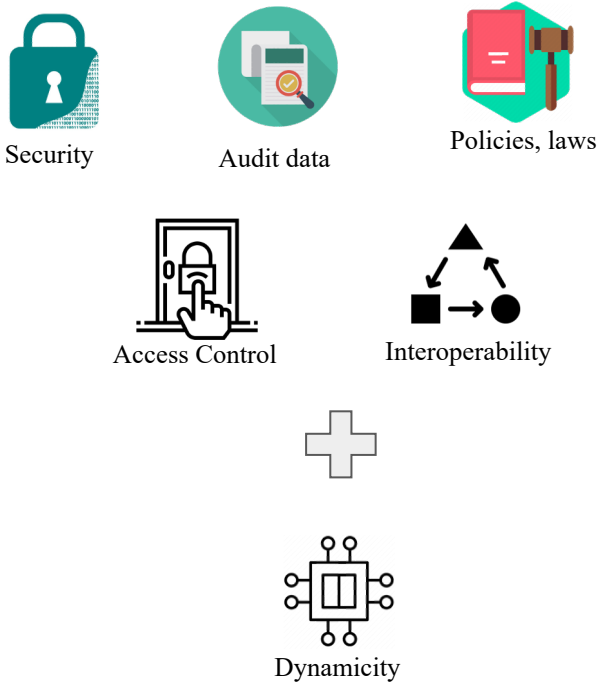
EPI: Enabling Personalized Interventions

We need an adaptive framework to enable secure data-sharing across health domains

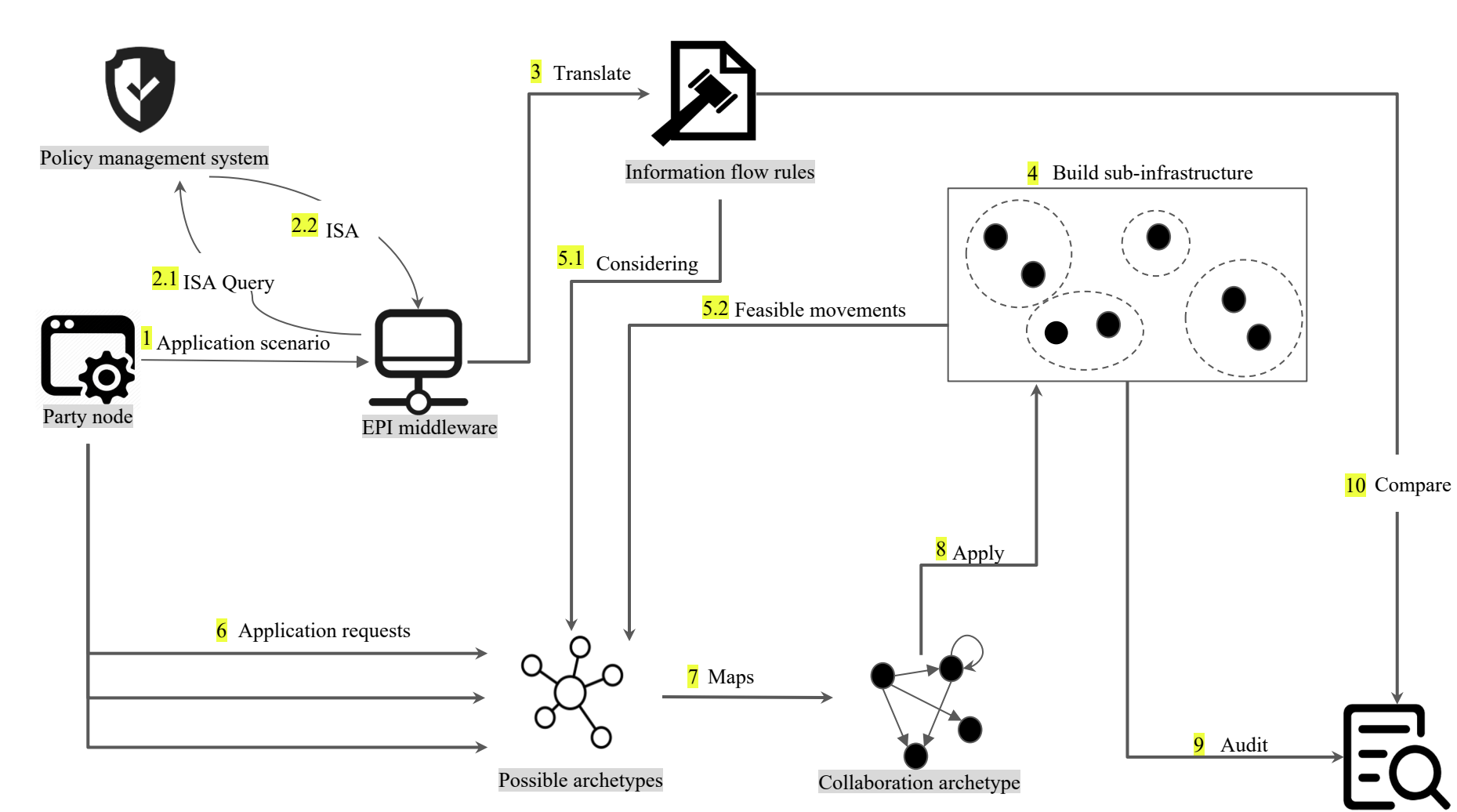


Medical Data Sharing & Frameworks

- Frameworks rely on single specific technologies or devices
- Frameworks are catered to satisfy a specific use case
- Application-specific
- Architecture rigid and hard to support different use cases
- **The EPI framework** formalises a methodology that adapts the EPI programmable infrastructure to different use cases.



High level view of the infrastructure workflow



Source: Jamila Alsayed Kassem, Cees de Laat, Arie Taal, and Paola Grosso, “The EPI Framework: A dynamic data sharing framework for healthcare use cases", IEEE Access journal

Assuming the set of rules captures consent, regulations, and law

The matrix of c represents the set of supported channels

r00	r01	r02	r03
r10	r11	r12	r13
r20	r21	r22	r23
r30	r31	r32	r33

^

c00	c01	c02	c03
c10	c11	c12	c13
c20	c21	c22	c23
c30	c31	c32	c33

Example (simplified to 1/0)

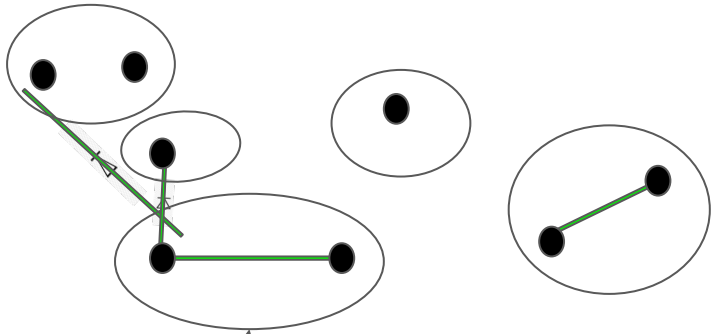
Information flow control Array

sender

receiver

1	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0
0	0	1	0	0	0	0	0
0	1	1	1	1	0	0	0
0	0	0	1	1	0	0	0
0	0	0	0	0	1	0	0
0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	1

Apply



In case the desired information flow defined the rules contradict with the supported channels

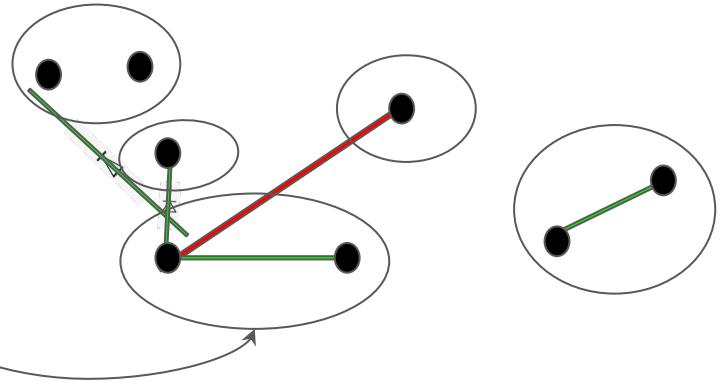
β

r00	r01	r02	r03
r10	r11	r12	r13
r20	r21	r22	r23
r30	r31	r32	r33

^

c00	c01	c02	c03
c10	c11	c12	c13
c20	c21	c22	c23
c30	c31	c32	c33

Apply



In case the desired information flow defined the rules contradict with the supported channels

Missing attribute

β

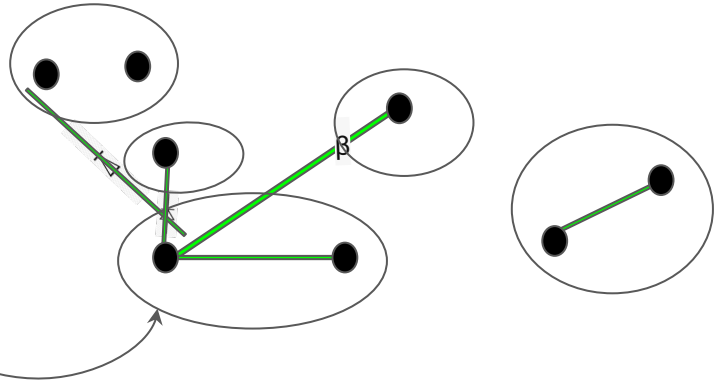
r00	r01	r02	r03
r10	r11	r12	r13
r20	r21	r22	r23
r30	r31	r32	r33

^

c00	c01	c02	δ(c03)
c10	c11	c12	c13
c20	c21	c22	c23
c30	c31	c32	c33

IFC Array

Apply



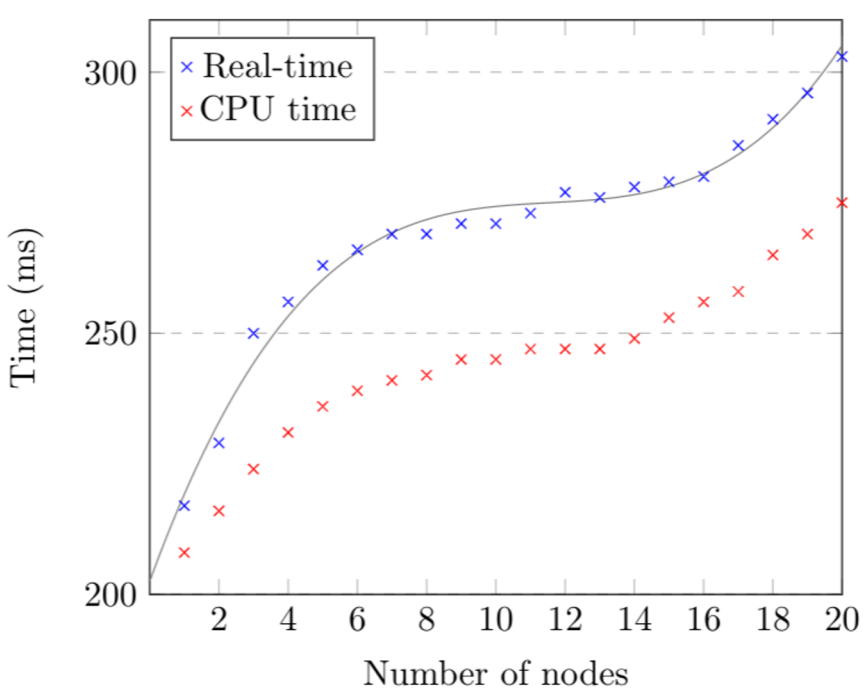
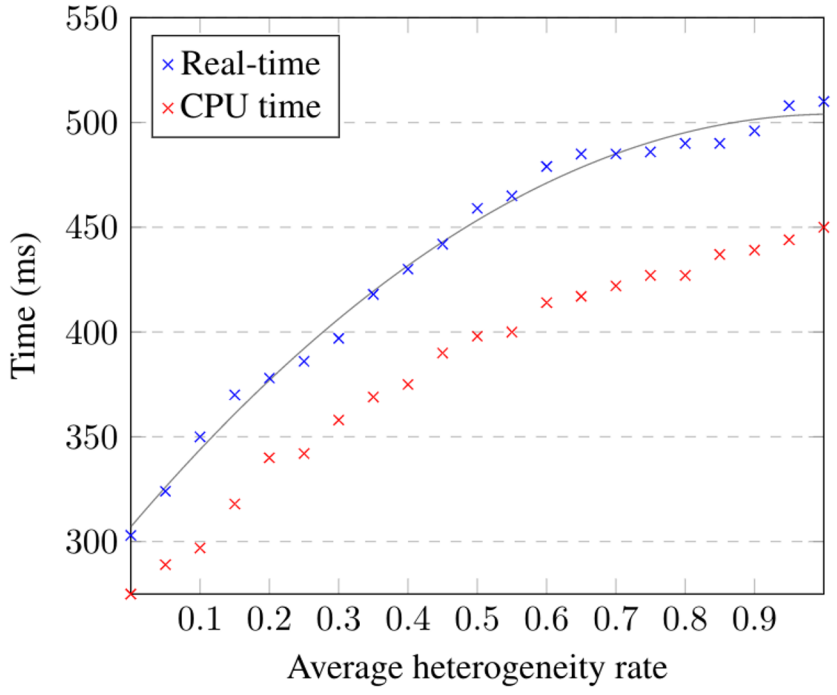
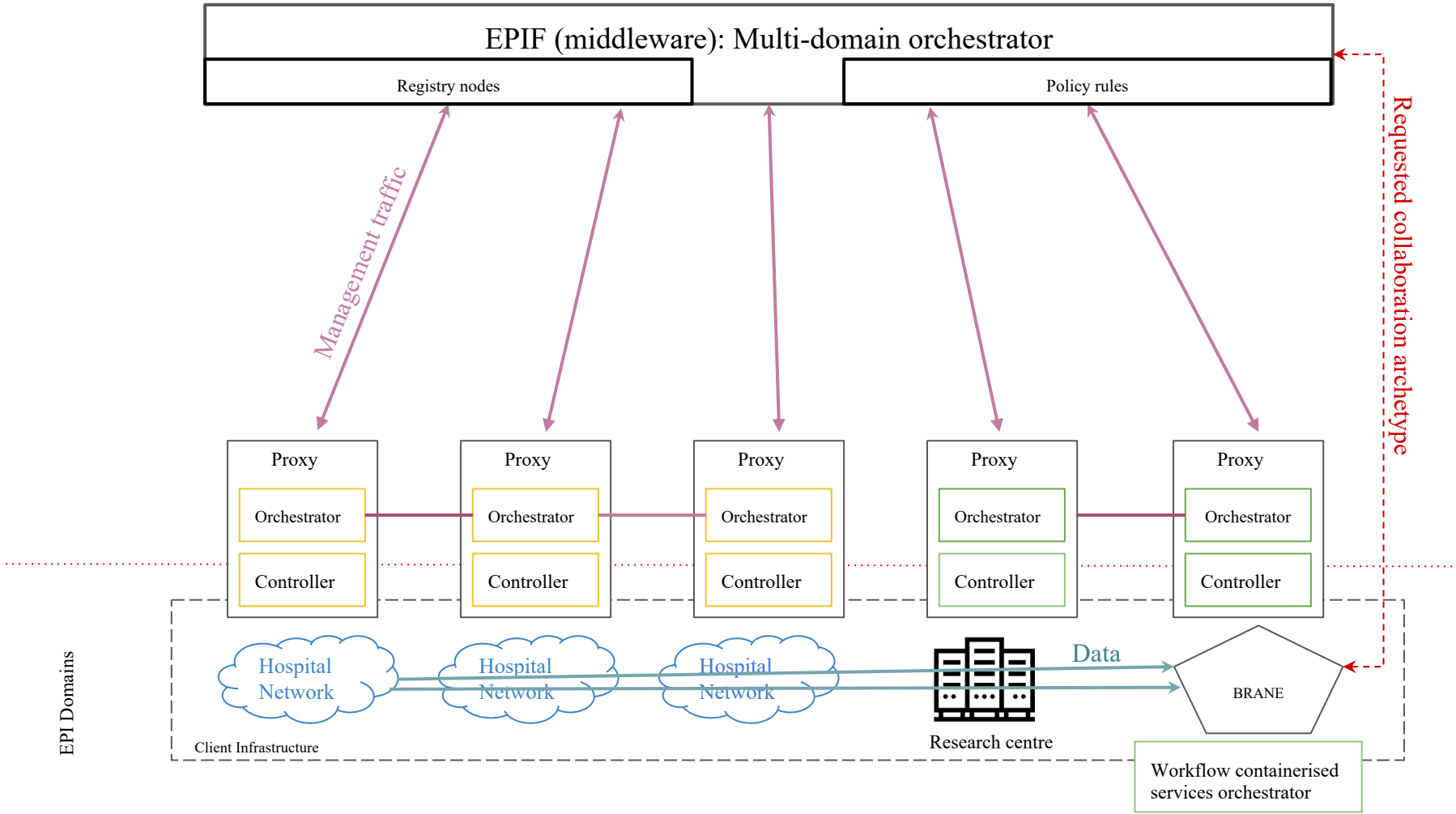


Figure 4: Script execution time depending on increasing input



The script execution time with respect to increasing AHR.

EPIF: from an infrastructural view


EPIF (middleware): Multi-domain orchestrator
Registry nodes
Policy rules
Requested collaboration archetype
Management traffic
Proxy
Orchestrator
Controller
Proxy
Orchestrator
Controller
Proxy
Orchestrator
Controller
Proxy
Orchestrator
Controller
Proxy
Orchestrator
Controller
EPI Domains
Hospital Network
Hospital Network
Hospital Network
Data
BRANE
Client Infrastructure
Research centre
Workflow containerised services orchestrator

Ongoing and future work

- Implementation in real testbeds
  - DSL to be used to express infrastructural set up requirements
  - Extra bridging functions
- Test bridging functions: performance and security
- Evaluate framework with different use cases: ML, streaming, EHR
- More experiments on implementation approach

- Dynamic policy:
  - Integrate by expressing policy
  - In terms of bridges
  - It is interesting to see if we can approach the policy change in a graceful or disruptive way
  - Multiple ways to abide policy: best way?