GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN IN PUBLICA COMMODA SEIT 1737

Georg-August-Universität Göttingen / GWDG

HPS NHR-NORD@GÖTTINGEN

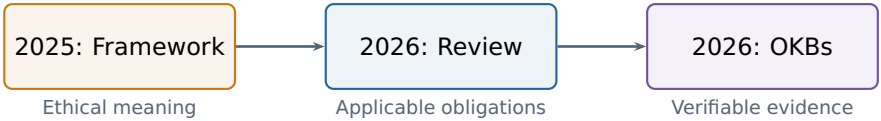
https://hps.vi4io.org/

Knowledge-Based HPC Decision Intelligence: Executable Governance for Trustworthy AI-Driven Decision Workflows

Aasish Kumar Sharma and Julian M. Kunkel

Presenter: Aasish Kumar Sharma

Research Path: Three Publications



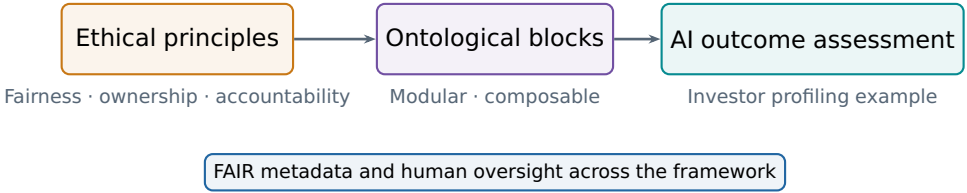
Research question

How can AI governance requirements become explicit, reusable, and verifiable?

2025: Ethical Evaluation Framework

IEEE COMPSAC 2025 · DOI: 10.1109/COMPSAC65507.2025.00344

Ethical AI: Towards Defining a Collective Evaluation Framework

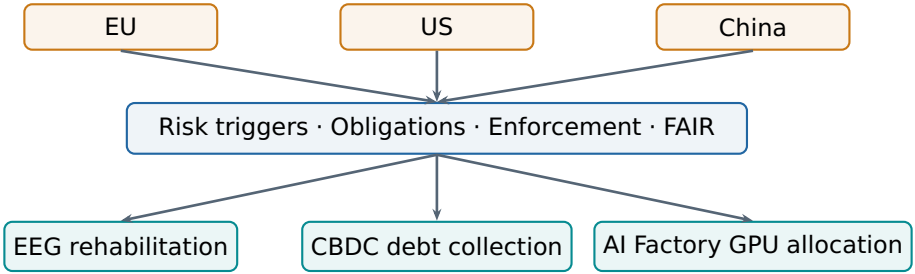


Conceptual contribution; not an implemented compliance engine.

2026: Global AI Regulations

IEEE COMPSAC 2026 · DOI: 10.1109/COMPSAC69091.2026.00092

Global AI Regulations for FAIR and Ethics in High-Risk Use Cases: A Comparative Review



Comparative study of regulatory obligations and three use cases, not a formal compliance implementation.

Regulatory Findings

Legal scope

Overlapping duties

Evidence portability

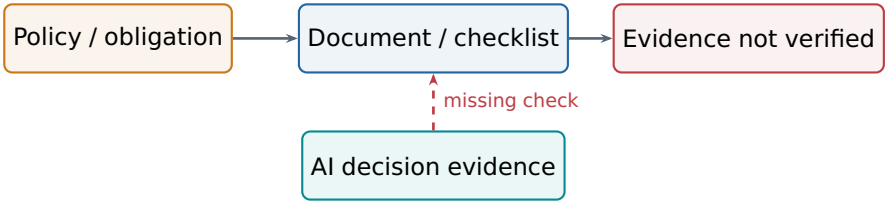
Implication

Governance needs reusable, machine-checkable evidence requirements.

Scope

HPC resource allocation is not automatically high-risk under the EU AI Act.

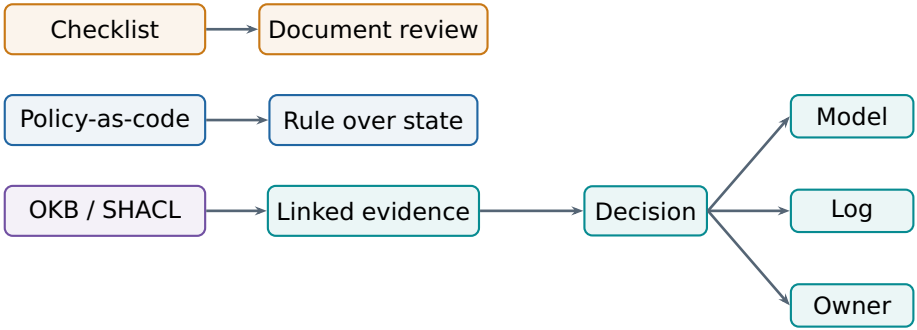
From Policy Documents to Decision Checks



Research question

Can approved obligations be tested against each AI decision's evidence?

Why OKBs? Linked Evidence



Added capability

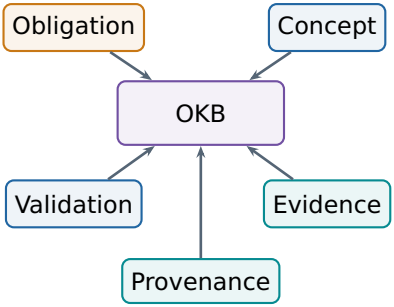
Shared concepts · traceable relationships · reusable validation profiles

Complementary, not benchmarked. Sources: OPA, OWL, SHACL, PROV-O.

2026: Ontological Knowledge Blocks

IEEE COMPSAC 2026 Workshop · DOI: 10.1109/COMPSAC69091.2026.00379

Ontological Knowledge Blocks: Executable Compliance and Profile-Based Validation for Trustworthy AI Systems



Formal model

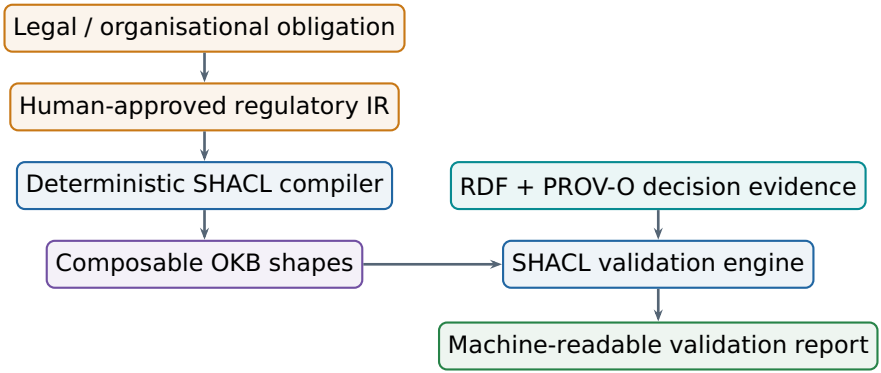
$$KB = \langle O, C, V, E, P \rangle$$

Standards

RDF/OWL · SHACL · PROV-O

Approved rules; deterministic checks

Executable Compliance Pipeline

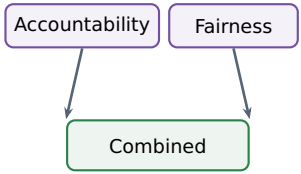


Selecting Compliance Checks with a Profile

Illustrative Turtle profile

```
@prefix : <https://example.org/okb#> .

:Accountability a :Profile ;
  :usesCheck :DecisionLog, :ModelTrace .
:Fairness a :Profile ;
  :usesCheck :Explanation, :Disparity .
:Combined a :Profile ;
  :includes :Accountability, :Fairness .
```



A profile selects checks. Turtle is a simplified illustration, not a reproduced source artifact.

Test Case: GPU-hour Allocation

Illustrative decision

An AI-assisted HPC service allocates GPU-hours to two groups.
The selected profile checks disparity against a declared threshold.

Illustrative check

$$r = |a - b| / \max(a, b)$$

Flag a violation if $r > 0.20$.

Conformant evidence

$a = 120$, $b = 110$ GPU-h

$r \approx 0.083$ ✔

Violation evidence

$a = 200$, $b = 50$ GPU-h

$r = 0.75$ ✘

Constructed evidence and threshold; not a legal fairness standard.

What Was Validated?

Constructed HPC decision evidence

Decision log · model identity · explanation · GPU-hour allocation

Profile prototype: 12 checks

3 evidence cases × 4 jurisdiction-oriented profiles

Compiler prototype: 12 checks

4 evidence cases × 3 governance profiles

Question: Does the selected profile detect the expected missing or invalid evidence?

24 handcrafted runs; no operational or cross-tool benchmark.

Result: Profile-Dependent Findings

HPC decision cases: checked against accountability and fairness obligations.

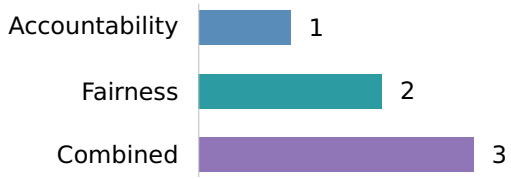
Constructed evidence	Accountability	Fairness	Combined
Complete decision record	✔	✔	✔
No explanation attached	✔	✘	✘
GPU disparity above limit	✔	✘	✘
No model artifact link	✘	✔	✘

Interpretation

✔ checks satisfied ✘ evidence violation detected

A pass refers only to the selected, encoded checks, not overall legal or ethical compliance.

Result 2: Composable Coverage



Observed refinement

Combined $\sqsubseteq$ Accountability

Combined $\sqsubseteq$ Fairness

Neither converse holds.

Number of violation classes in the tested suite, not global regulatory coverage.

What Is Done and What Remains Open?

Done

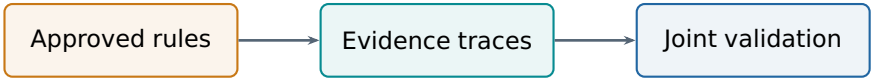
- Deterministic SHACL compilation
- Profile-sensitive validation
- Composable violation checks
- Checks on constructed cases

Open

- Comprehensive legal coverage
- Real-world deployment and scale
- Forged evidence detection
- Domain-specific fairness validity

Evidence validation does not itself prove legal compliance or ethical correctness.

AIF Working Group: Collaboration

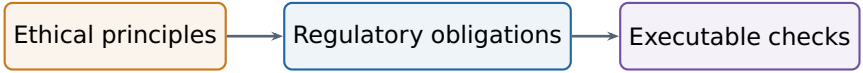


Proposed joint pilot

One policy profile · One decision workflow · Reproducible evaluation

Discussion: datasets, domain experts, and integration partners

Takeaway and Discussion



Next step

Cross-domain validation with AIF collaborators

aasish-kumar.sharma@gwdg.de hps.vi4io.org