

# iObserve<sup>2</sup>

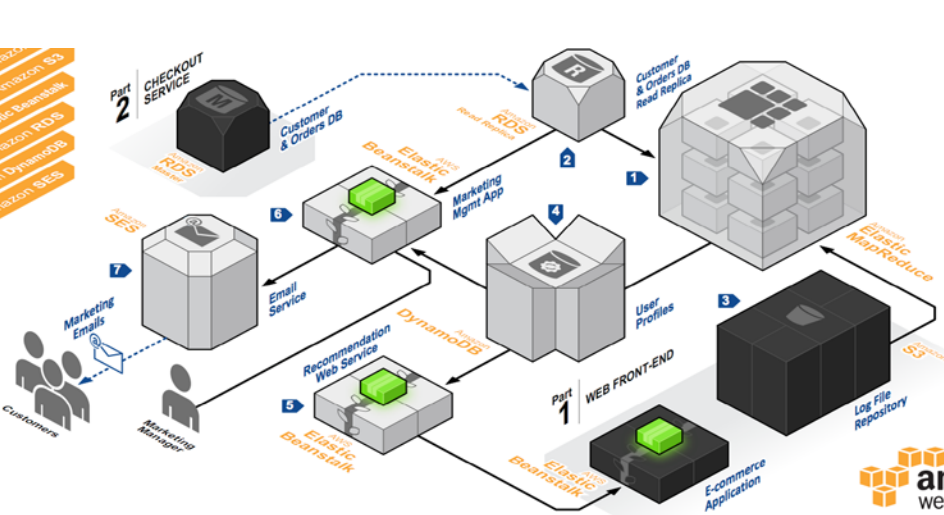
Integrated Observation and Modeling  
Techniques to Support Adaptation and  
Evolution of Software Systems

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Ralf Reussner (KIT), Eric Schmieders (UDE)

*Renewal Kickoff Workshop of the DFG Priority Programme 1593  
Hannover, January 14 – 15, 2016*

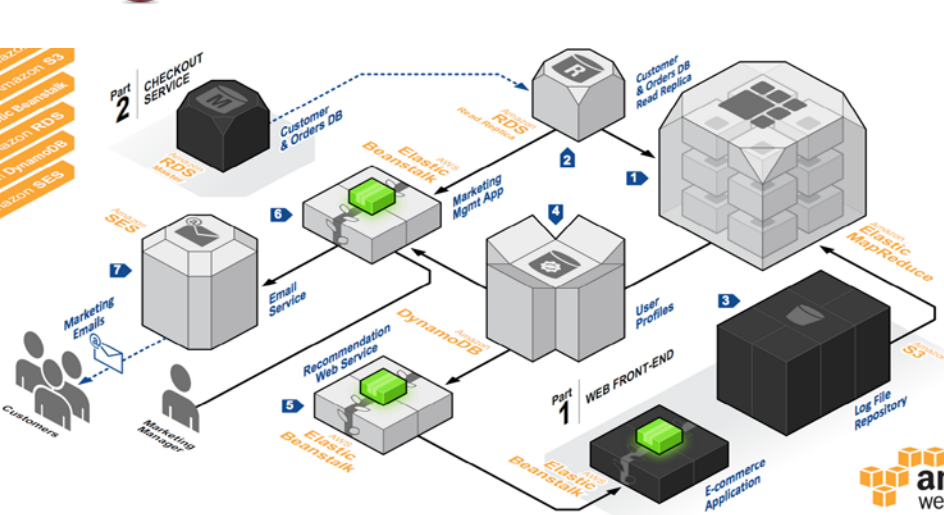
## Trends for software-intensive systems

- **Usage of third-party software-defined services**
  - Systems built by selecting, configuring, and composing services
  - Software usage separated from software ownership, maintenance, and operation
  
- **Deployment on Distributed / virtualized “cloud” infrastructures**
  - Processing and storage, software-defined networks, Internet-of-Things/CPS
  - Hardware resources and middleware owned and operated by (many) third parties



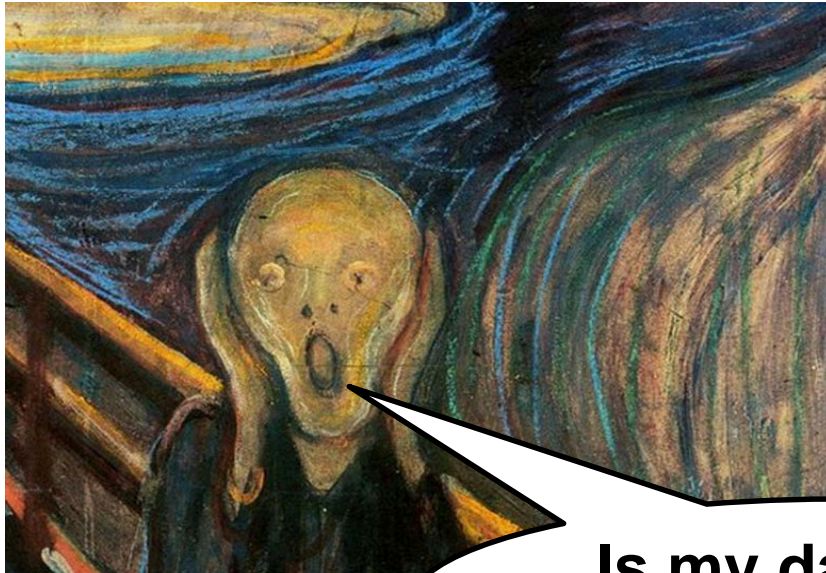
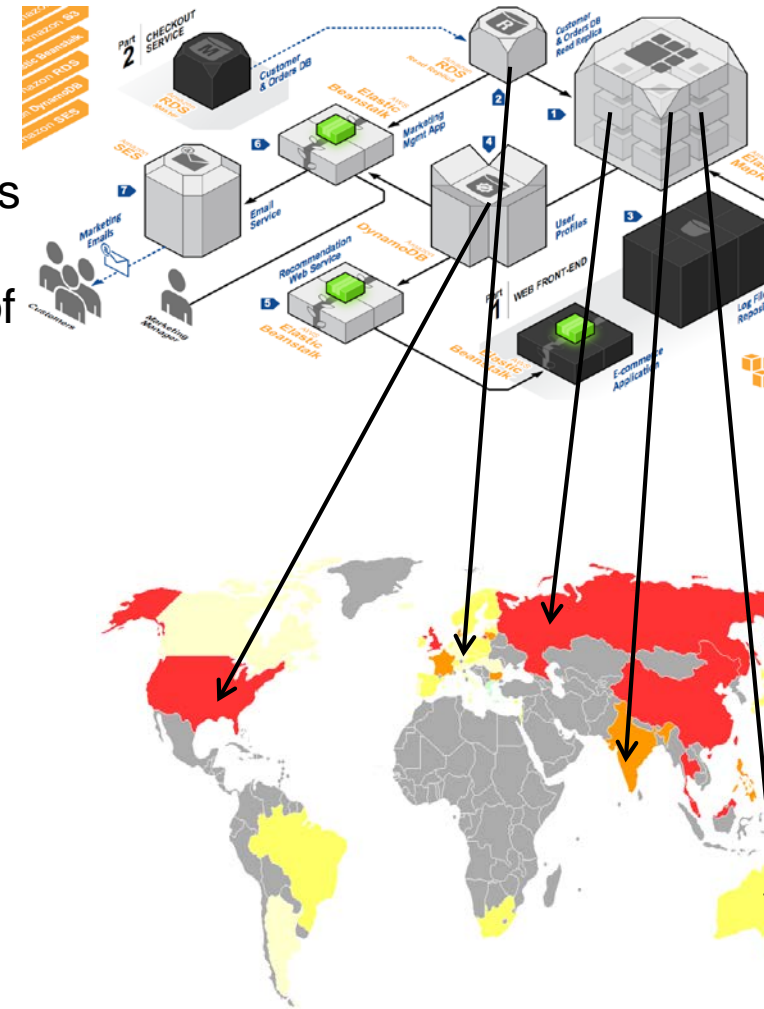
## Pros and Cons of Cloud and Services

- + Flexibility, scalability, reusability
- + Economic use of resources
- Unprecedented complexity and heterogeneity
- Design-time uncertainty (need for run-time adaptation and evolution)
- Limited observability



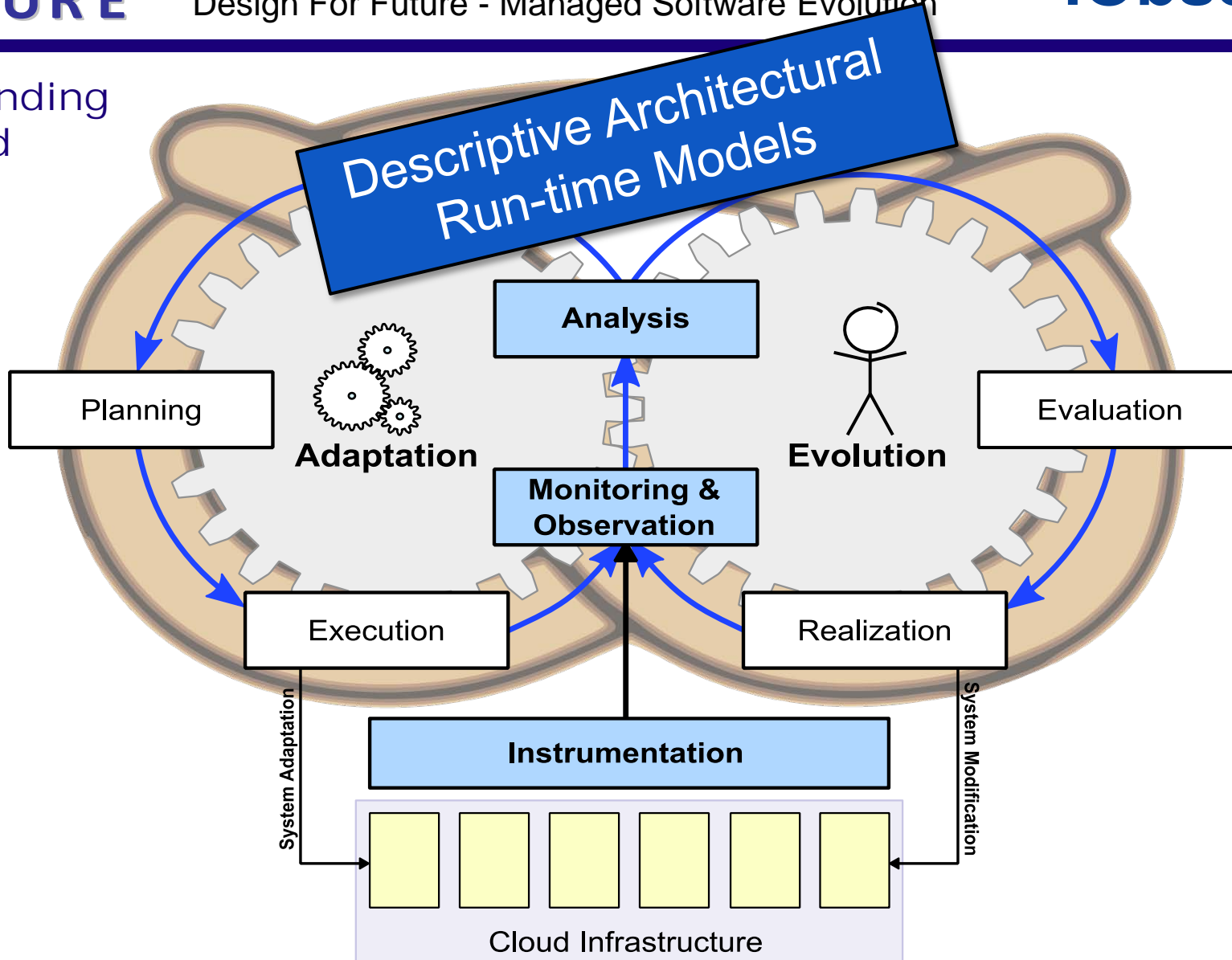
One Key Challenge: **Data Protection**

- ❖ **Dynamic migration / replication** of cloud resources
- ❖ Complexity, **geographic distribution** of cloud services and their data (e.g., Hadoop, Spark, ...)
- ❖ **Dynamic reclassification** of data (e.g., aggregation of personal data)



Is my data (still) protected?

1<sup>st</sup> Funding  
Period



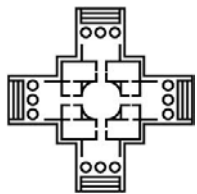


## Results of the 1st Funding Period

- **Instrumentation:** Model-driven instrumentation of dynamic Cloud applications

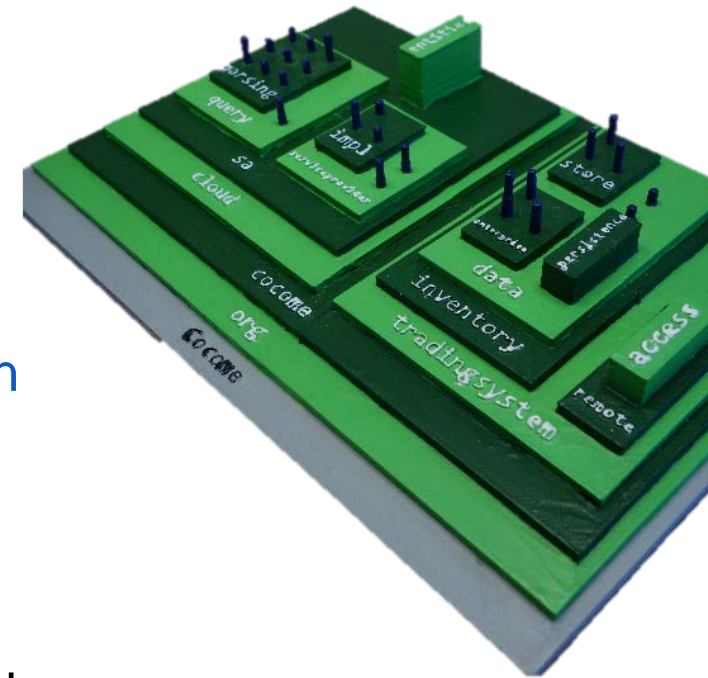


- **Monitoring & Observation:** Architectural run-time models for automated adaptation & manual evolution

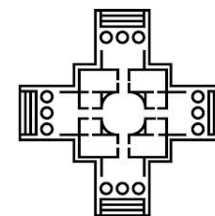
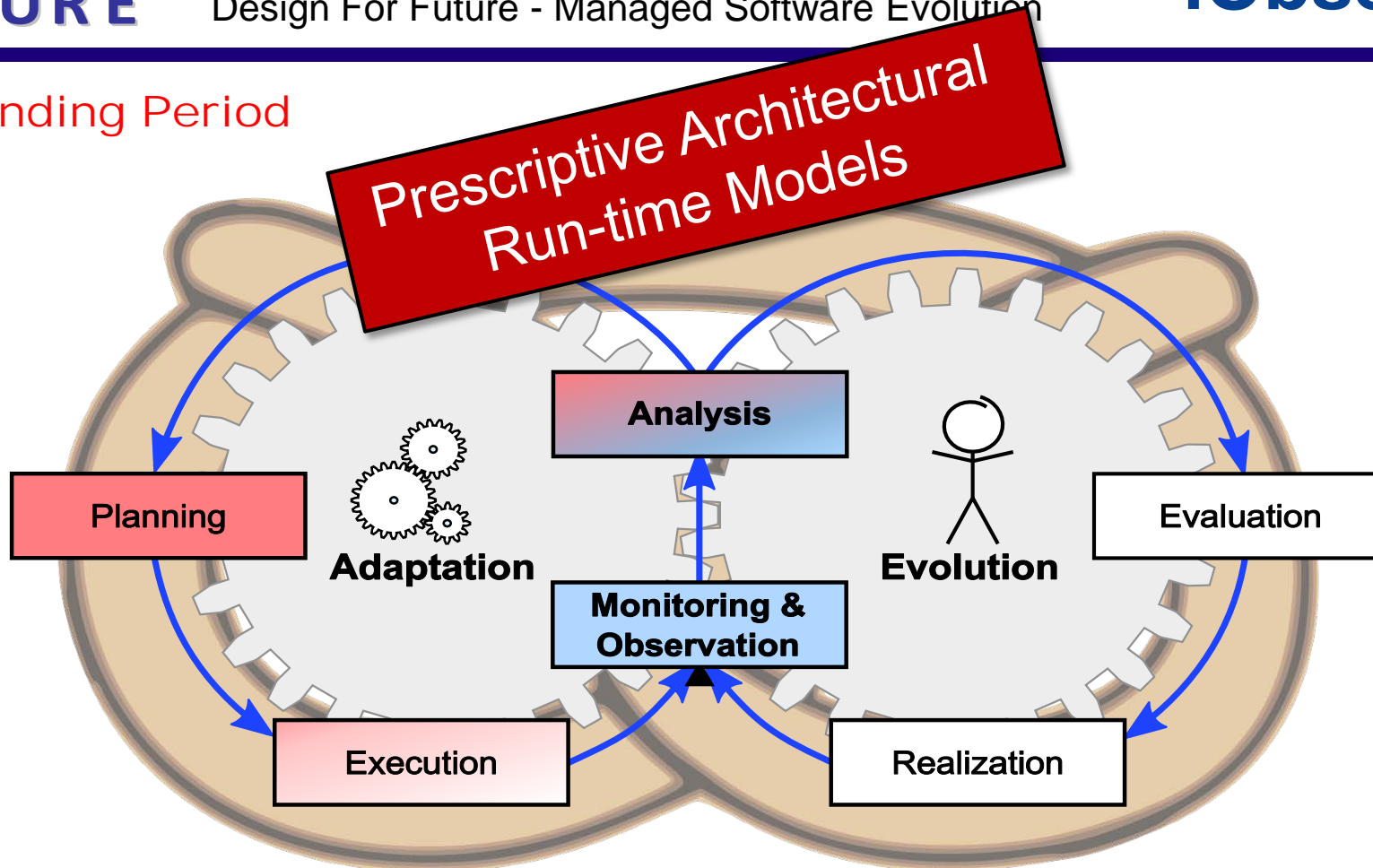


ExplorViz

- **Analysis:** Model-based analysis of performance and privacy



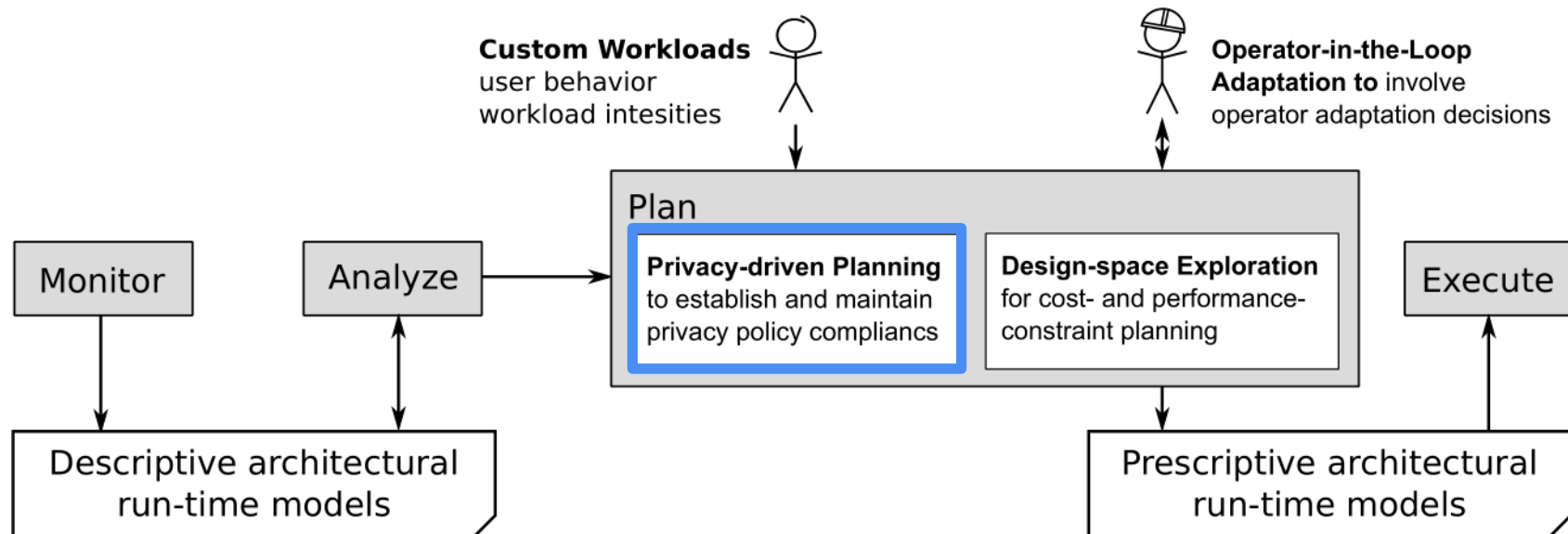
2<sup>nd</sup> Funding Period



## Project Goals for 2nd Funding Period

❖ Privacy-driven planning

- **Extended run-time models** to reflect cloud adaptation mechanisms
- **Constraint-based generation** of adaptation alternatives from run-time models
- **Impact analysis** of privacy related adaptations on other quality requirements (such as performance)

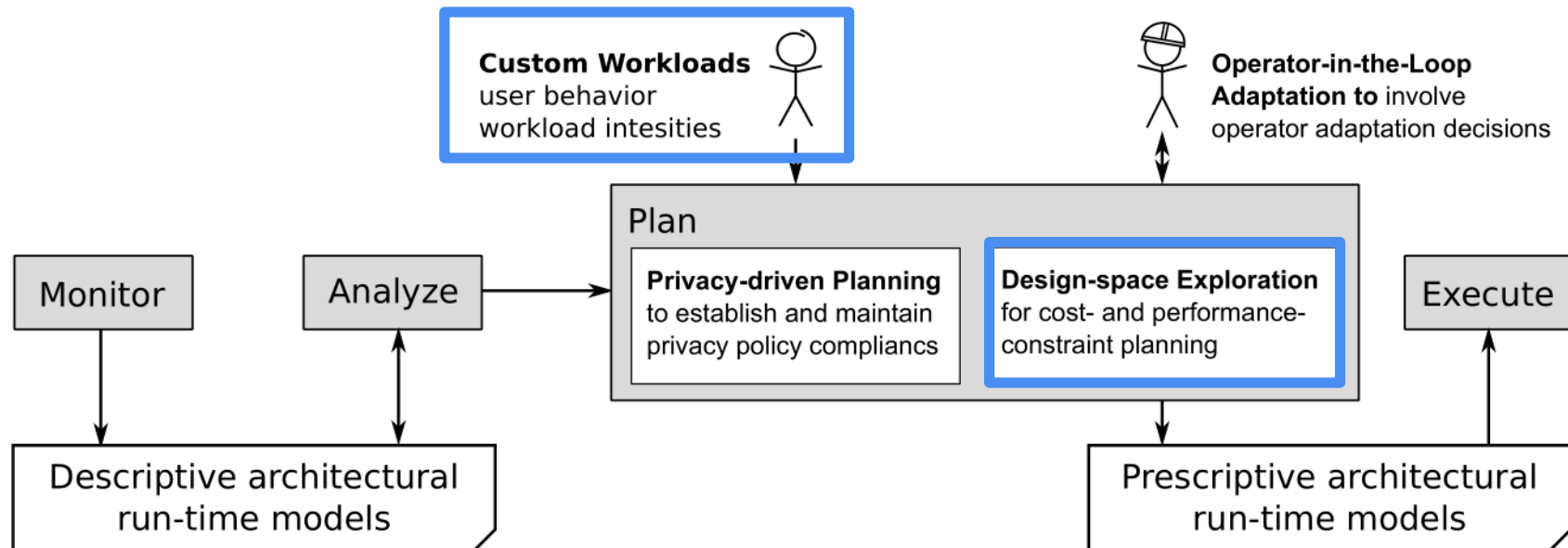




## Project Goals for 2nd Funding Period

### ❖ Design-space exploration

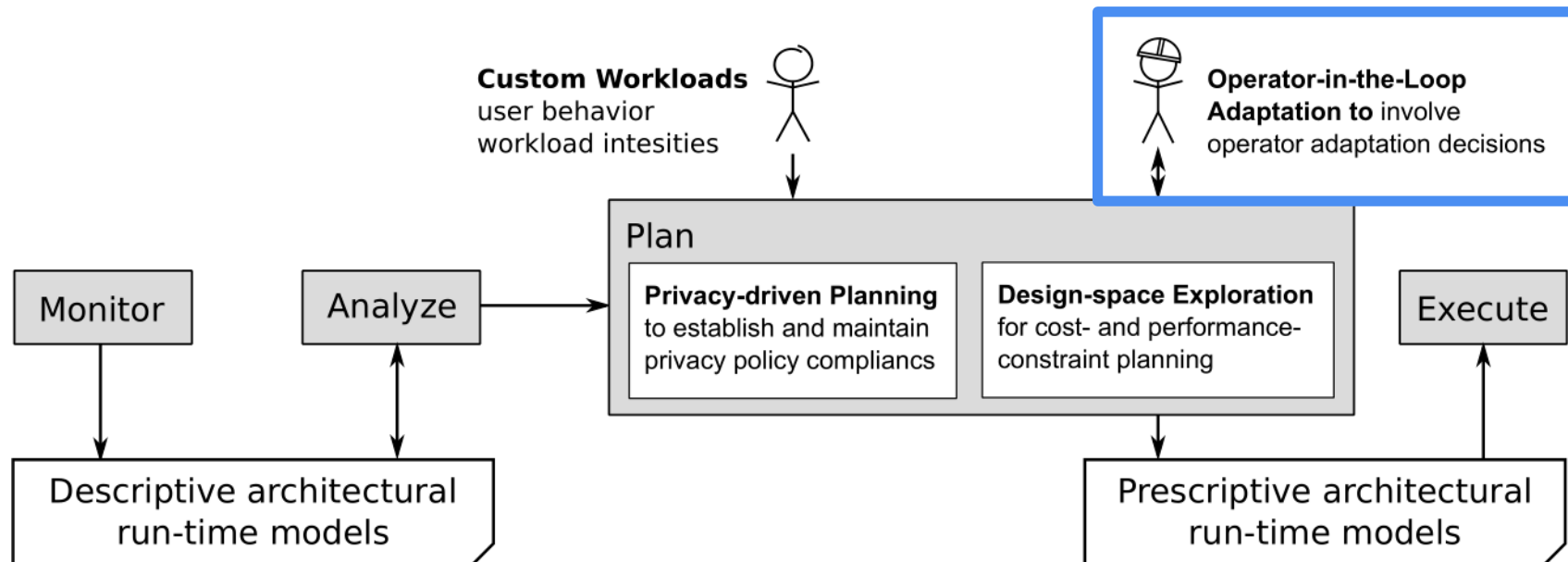
- Extended run-time models to reflect dimensions for architectural adaptations
- Generation and evaluation of adaptation plans (~ design alternatives) during runtime
- Translation of adaptation plans into detailed adaptation tasks (for actual execution)



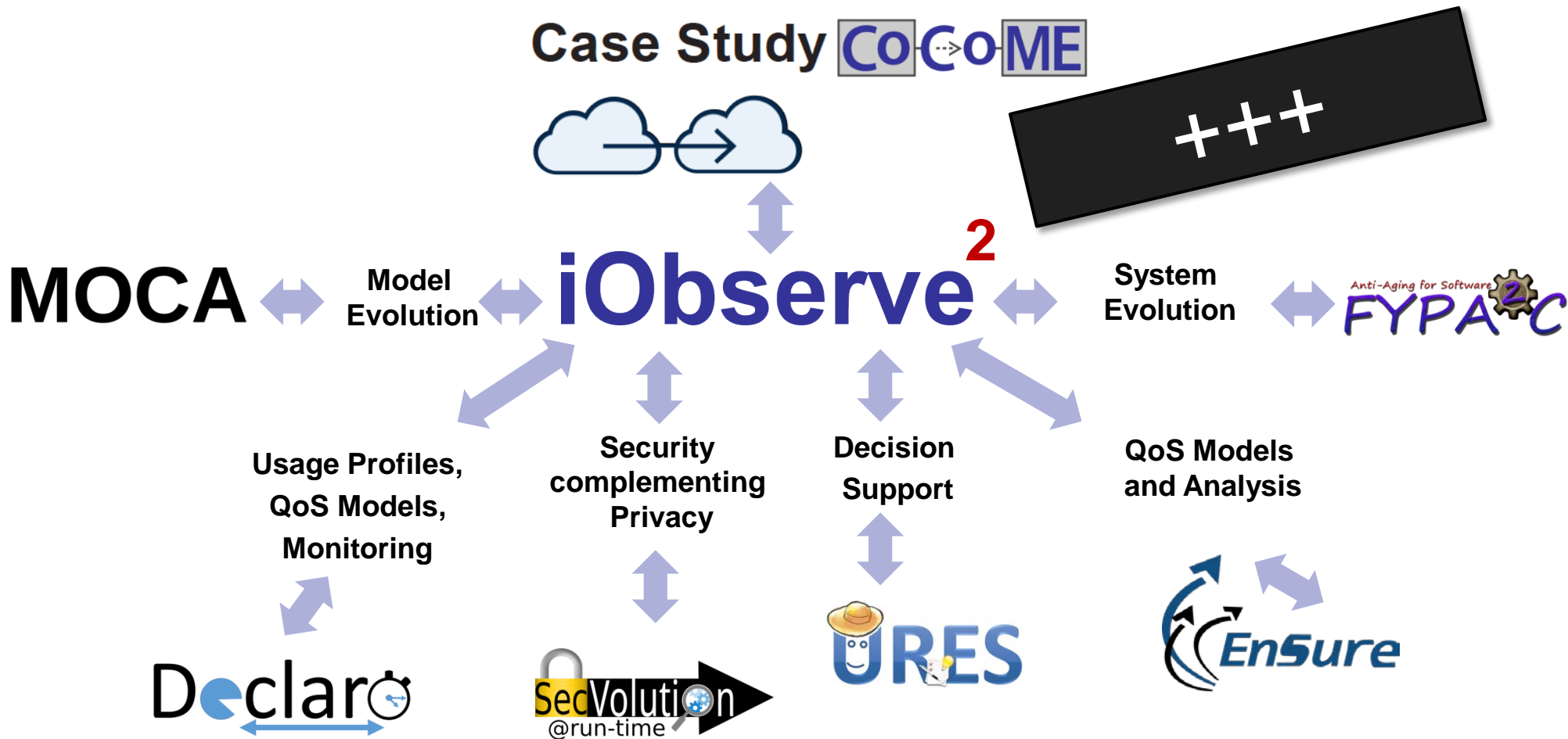
## Project Goals for 2nd Funding Period

❖ Operator-in-the-loop adaptation

- **DevOp-Dashboard** for providing information on **system context** (e.g., new data handling policies, changed workload models)
- **DevOp-Dashboard** for (visual) decision support in selecting **adaptation plans** (where self-adaptation is not feasible / wanted)



Planned Cooperations in 2nd Funding Period



## Publications (excerpt)

- Florian Fittkau, Jan Waller, Christian Wulf, Wilhelm Hasselbring: “Live Trace Visualization for Comprehending Large Software Landscapes: The ExplorViz Approach“, In: 1st IEEE International Working Conference on Software Visualization (VISSOFT 2013).
- Florian Fittkau, Sascha Roth, Wilhelm Hasselbring: “ExplorViz: Visual Runtime Behavior Analysis of Enterprise Application Landscapes“, In: 23rd European Conference on Information Systems (ECIS 2015).
- Heinrich, R., Jung, R., Schmieders, E., Metzger, A., Hasselbring, W., Reussner, R., Pohl, K., 2015. Architectural run-time models for operator-in-the-loop adaptation of cloud applications, in: Maintenance and Evolution of Service-Oriented and Cloud-Based Environments (MESOCA), 2015 IEEE 9th International Symposium on the. Presented at the Maintenance and Evolution of Service-Oriented and Cloud-Based Environments (MESOCA), 2015 IEEE 9th International Symposium on the, pp. 36–40.
- Heinrich, R., Schmieders, E., Jung, R., Rostami, K., Metzger, A., Hasselbring, W., Reussner, R.H., Pohl, K., 2014. Integrating Run-time Observations and Design Component Models for Cloud System Analysis, in: Götz, S., Bencomo, N., France, R.B. (Eds.), Proceedings of the 9th Workshop on Models@run.time Co-Located with 17th International Conference on Model Driven Engineering Languages and Systems (MODELS 2014), Valencia, Spain, September 30, 2014, CEUR Workshop Proceedings. CEUR-WS.org, pp. 41–46.
- Jung, R., Heinrich, R., Schmieders, E., Strittmatter, M., Hasselbring, W., 2014. A Method for Aspect-oriented Meta-Model Evolution, in: Proceedings of the 2Nd Workshop on View-Based, Aspect-Oriented and Orthographic Software Modelling, VAO '14. ACM, New York, NY, USA, pp. 19:19–19:22.
- Schmieders, E., Metzger, A., Pohl, K., 2015b. Runtime Model-Based Privacy Checks of Big Data Cloud Services, in: Barros, A., Grigori, D., Narendra, N.C., Dam, H.K. (Eds.), Service-Oriented Computing, Lecture Notes in Computer Science. Springer Berlin Heidelberg, pp. 71–86.
- Schmieders, E., Metzger, A., Pohl, K., 2015a. Architectural Runtime Models for Privacy Checks of Cloud Applications, in: Proceedings of the 7th International Workshop on Principles of Engineering Service-Oriented and Cloud Systems, PESOS 2015. ACM, New York, NY, USA
- Schmieders, E., Metzger, A., Pohl, K., 2014. A Runtime Model Approach for Data Geo-location Checks of Cloud Services, in: Franch, X., Ghose, A.K., Lewis, G.A., Bhiri, S. (Eds.), Service-Oriented Computing - 12th International Conference, Lecture Notes in Computer Science. Springer Berlin Heidelberg, pp. 306–320

## Jointly Edited Proceedings

- Heinrich, R., Jung, R., Konersmann, M., Schmieders, E., 2015. 2nd Collaborative Workshop on Evolution and Maintenance of Long-Living Systems (EML), in: Software Engineering & Management 2015, Multikonferenz Der GI-Fachbereiche Softwaretechnik (SWT) Und Wirtschaftsinformatik (WI), FA WI-MAW, 17. März - 20. März 2015, Dresden, Germany. p. 267.
- Heinrich, R., Jung, R., Konersmann, M., Ruhroth, T., Schmieders, E., 2014. 1st Collaborative Workshop on Evolution and Maintenance of Long-Living-Systems (EMLS14), in: Software Engineering 2014, Fachtagung Des GI-Fachbereichs Softwaretechnik, 25. Februar - 28. Februar 2014, Kiel, Deutschland. pp. 203–204.