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NACHRICHTENTECHNIK Dialogue Systems

A Multimodal Dialogue Framework for Cloud-Based Companion Systems

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Companion System

- Technical system that imitates human cognitive capabilities:
  - Perception and cognition
  - Learning and Memory
  - Planning and reasoning
  - Interaction

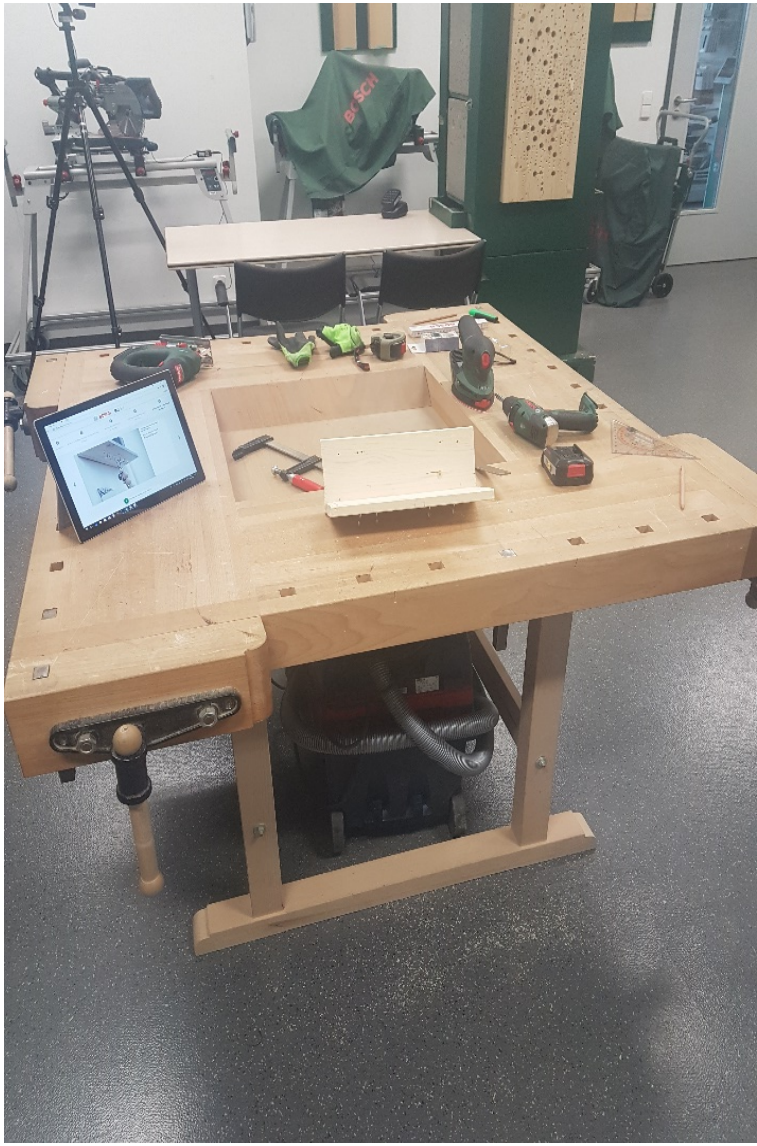
- Possesses *Companion*-Characteristics:
  - Competence
  - Individuality and adaptability
  - Availability
  - Cooperativeness
  - Trustworthiness

➢ Reliable human-like assistive system aiming at helping users in complex tasks

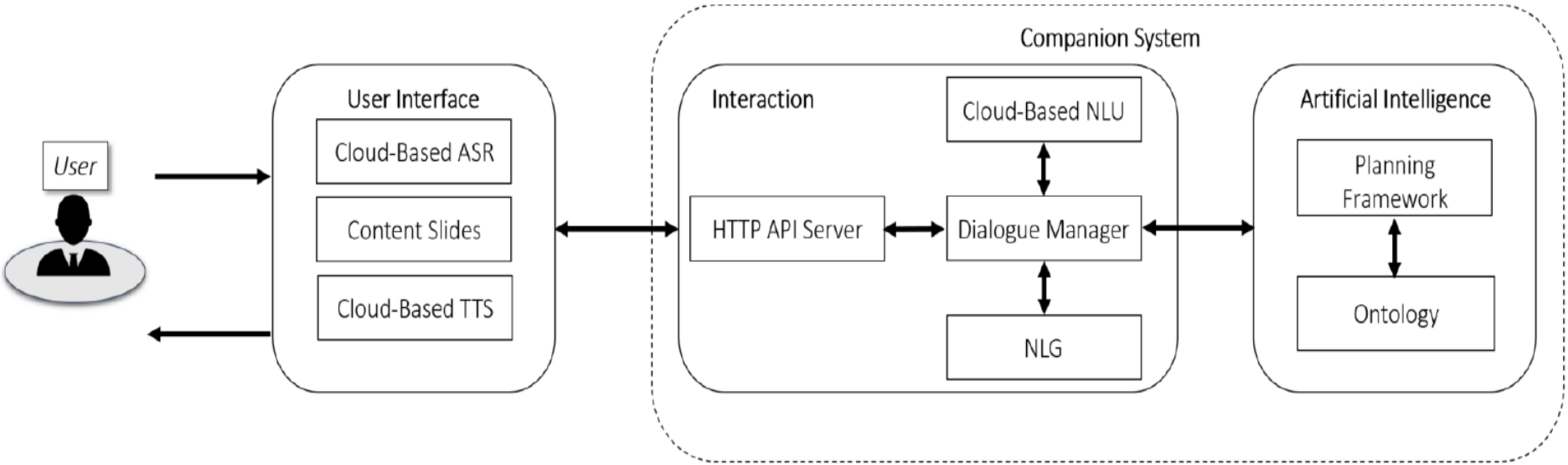
Biundo, S., & Wendemuth, A. (2016). Companion-technology for cognitive technical systems. Künstliche Intelligenz, 30(1), 71–75. (Special Issue on Companion Technologies) doi: 10.1007/s13218-015-0414-8

Application Scenario

- Industrial Project with Bosch Corperate Research
- Goal: Development of a sophisticated personal assistant for providing individual step-by-step guidance in the performance of a DIY-project and the usage of power tools
- Use case: Building of a keyrack using a drilldriver and a jigsaw
- Companion System implemented as a cloud-service for being accessible via web requests

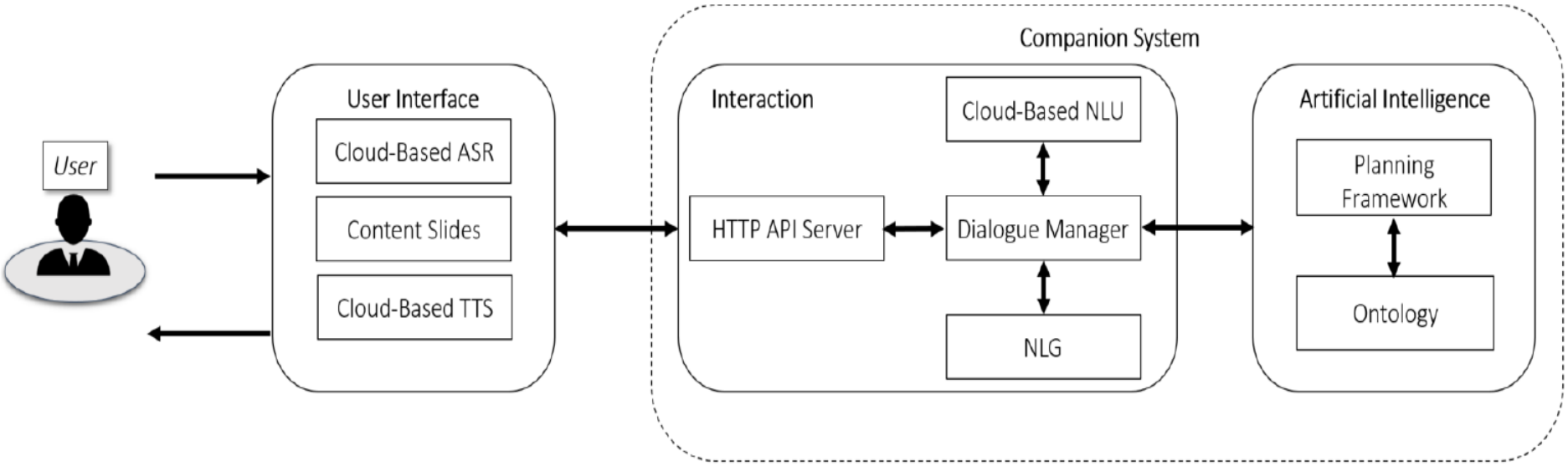


Multimodal Cloud-Based Architecture



- User Interface:
  - Implemented as scalable front-end web page
  - Multimodal graphical interface (natural speech, touch, swipe gestures)
  - Instructions presented as a sequence of multimedia slides (text, image, video)
  - Fowards user input as HTTP-Requests in form of JSON data

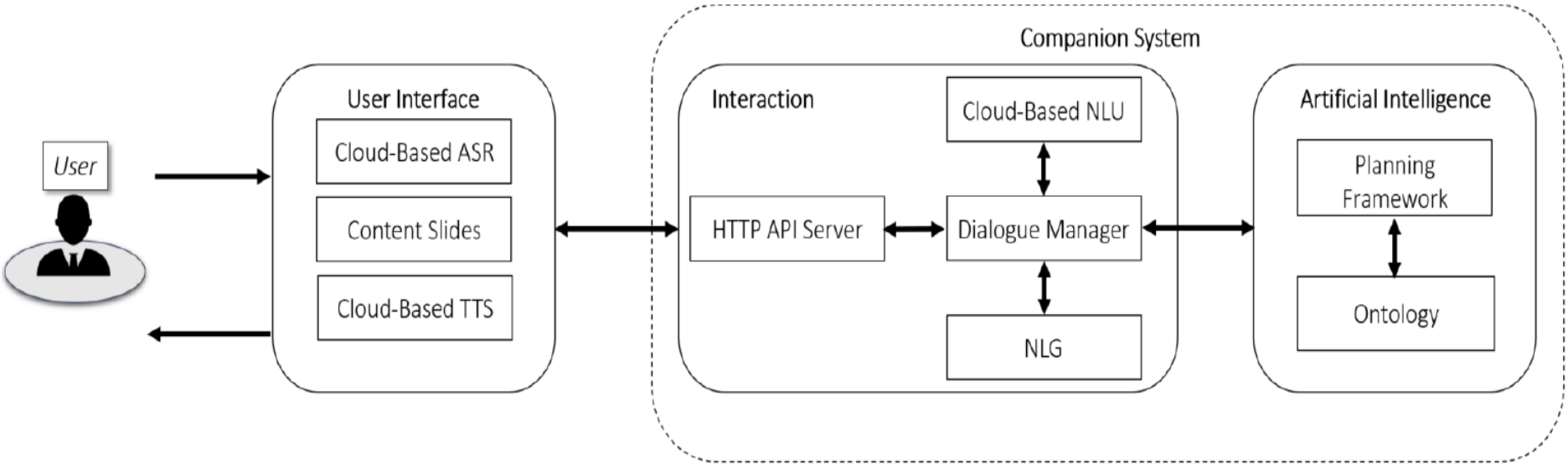
Multimodal Cloud-Based Architecture



- Interaction Components:
  - HTTP API Server for handling web requests from interface and authentication of users
  - *Language Understanding Intelligent Service* (LUIS) for NLU of user input
  - Dialogue Manager controls interaction by selecting best result from either DM-related, Planning-related, or Ontology-related NLU-model
  - NLG based on text patterns stored in the Ontology

Williams, J. D., Kamal, E., Ashour, M., Amr, H., Miller, J.,& Zweig, G. (2015). Fast and easy language understanding for dialog systems with microsoft language understanding intelligent service (LUIS). In Proceedings of the 16th annual meeting of the special interest group on discourse and dialogue (SIGDIAL) (pp. 159–161). Association for Computational Linguistics.

Multimodal Cloud-Based Architecture



- Artificial Intelligence Components:
  - Hierarchical Planning Framework for providing procedural knowledge
  - Ontology reasoning for providing factual knowledge formulated in OWL 2 and for containing text templates and links to media content of instructional slides

Behnke, G., Höller, D., & Biundo, S. (2018). totSAT – Totally-ordered hierarchical planning through SAT. In Proceedings of the 32th AAAI Conference on AI (AAAI 2018). AAAI Press, 2018.

Schiller, M., Behnke, G., Schmautz, M., Bercher, P., Kraus, M., Dorna, M., . . . Biundo, S. (2017). A paradigm for coupling procedural and conceptual knowledge in companion systems. In Companion technology (ICCT), 2017 international conference on (pp. 1–6).

Conclusion and Future Directions

- Development and implementation of a cloud-based *Companion System*
- First prototype currently evaluated at Bosch labs regarding usability and user perceived trust in the system
- Integration of proactive dialogue strategies in near future for offering a deeper and more human-like level of assistance