ABSTRACT
Monitoring is a promising technique to detect erroneous behavior of a composite service at run-time, which is to complement static verification and validation techniques. One of the most important aspects of monitoring approach is that the specification of the properties without losing expressive power should be as simple as possible, facilitating the developers to represent the properties of the composite service. Consequently, we prefer to use Modal Sequence Diagrams that are the modal extension of UML 2.0 Sequence Diagrams as our property specification. Modal Sequence Diagrams are not only simple enough but also have powerful expressive power. We first define the formal syntax and semantics of Modal Sequence Diagrams, and measure the expressiveness based on Property Specification Patterns. Then, a novel framework is proposed to monitor temporal properties of the composite service with Modal Sequence Diagrams. Finally, a series of experiments based on On-the-Job Assistant case study have been conducted to validate our approach.

INDEX TERMS
• IEEE terms
  Application software, Automata, Computerized monitoring, Educational institutions, Heart, Logic, Runtime environment, Software engineering, Unified modeling language, Web services

• INSPEC
  o Controlled Indexing
    Unified Modeling Language, Web services, program verification, sequences, system monitoring, temporal logic

  o Non Controlled Indexing
    UML 2.0 sequence diagrams, composite services monitoring, formal semantics, formal syntax, modal extension, on-the-job assistant case study, property specification patterns, run-time error, static validation technique, static verification technique, universal modal sequence diagrams

• Author Keywords
  composite service, universal Modal Sequence Diagrams

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