

# Dependability Analysis

Whitepaper

## 1. Dependability in today's IT infrastructures

IT has become a mission critical component in the operation of businesses, as more and more business services and business support services depend on it. Therefore, minimizing the speed of finding failed components in the infrastructure and estimating the impact of failures on the services provided are high priority goals for all IT support operations.

However, the size and complexity of IT systems also shows a fast paced growth. Most enterprises and mid-sided businesses deploy some sort of infrastructure monitoring, but these typically do not give advice about the possible root causes and impacts of the problems sensed.

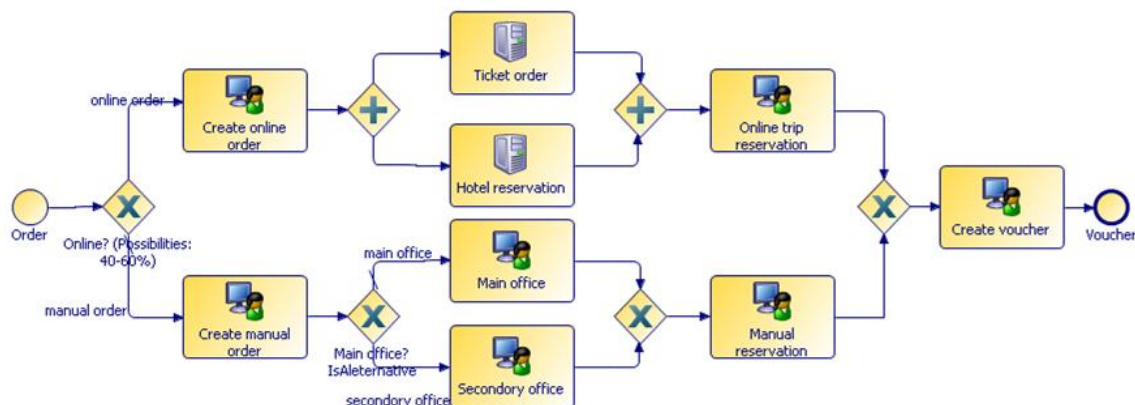
To address this necessity, optXware has developed a solution for finding root causes and estimating impacts of component failures on-line, based on monitoring data, formalized expert knowledge and a system model. This whitepaper introduces the approach and demonstrates its implementation as an Eclipse plugin.

## 2. Error Propagation and Business Processes

In order to be able to reason about error propagation in a distributed system of IT components providing business services, the following information is needed:

- description of the business processes implemented
- description of the allocation of the steps of the business process to infrastructural resources
- description of the error propagation characteristics of the individual component types

For business process and resource usage description purposes our plugin utilizes the freely available TIBCO Business Studio. In order to unify the formats of the individual vendors of business process modeling tools and workflow management systems, the Workflow Management Coalition elaborated a standard process design format called XML Process Definition Language (XPDL), a language that the Business Studio supports without restrictions. This way, our error propagation analysis solution supports an open standard for input data.



*An example XPDL business process describing the order process of a travel agency visualized in TIBCO Business Studio*

Error propagation characteristics are currently captured in a proprietary format as no standards exist in this domain, with the underlying Eclipse framework of the Business Studio equipped with editing capabilities. The error propagation analysis functionality embedded in the plugin relies on qualitative, static modeling. Components have a set of characteristic internal fault modes categorizing their error propagation behavior under different internal fault states. For instance, a fully functional switch will propagate erroneous as well as good data; however, it will transform malformed packet data errors to data omission errors on a data flow going through it. In contrast, a failed switch will replace even good data with data omission errors.

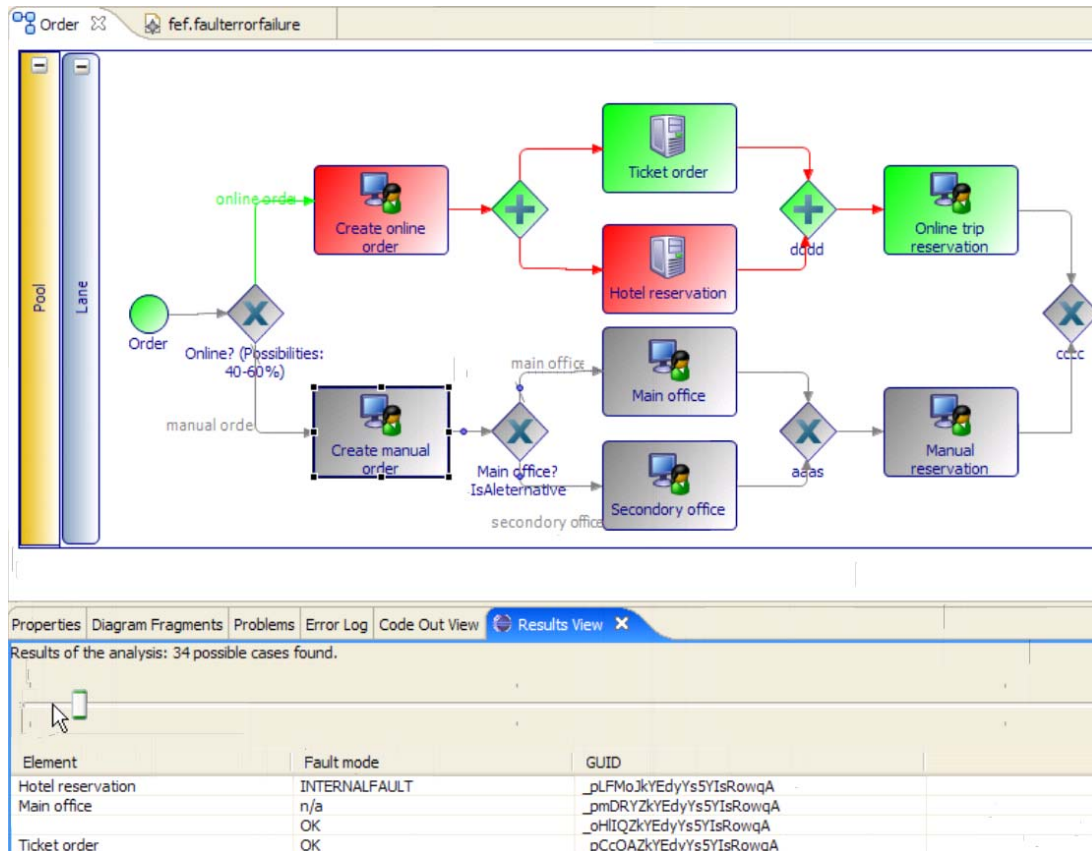
The qualitative nature of the approach means that the level of granularity of modeling faults, errors and failures is elective, and thus adaptable to the analysis needs and the level of knowledge of the system. Also, it can be iteratively refined, as more and more aspects of the system get captured by the input models.

The static nature of the approach manifests in the fact that no error automaton is maintained inside the components with respect to the input and output errors propagated. The two most important implications of static analysis are speed and significance ordering:

- the solver can avoid the combinatorial explosion characteristic of state-based analytic approaches; this makes the approach feasible even for large and complicated networks
- the solver produces the most serious data errors/failures allowed by the underlying hypotheses, masking the less significant ones, the handling of which has typically a lower priority

### 3. The Error Propagation Analysis Plugin

The error propagation analysis functionality is implemented as an Eclipse plugin. It is integrated with TIBCO Business Studio – also a product realized as a set of Eclipse plugins – to the level that not only modeling, but also the initiation of analysis and the visualization of the results can be done from the GUI provided by Business Studio.



*Analysis results and their visualization in TIBCO Business Studio*

Also, due to the consistent usage of the Eclipse Modeling Framework, the plugin can be easily adapted for alternative input modeling languages and custom result visualization needs.

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