



Cross-layer Adaptation and Monitoring of Service-Based Applications

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Outline

- Introduction
 - Service Based Applications (SBA)
 - Adaptation and Monitoring in SBAs
 - *What is missing in current approaches?*
- Why do we need a cross-layer approach?
 - Possible adaptation and monitoring problems due to lack of cross-layer approach
 - Case studies illustrating the identified problems
- Towards cross-layer adaptation and monitoring
 - A sample cross-layer solution for one of the case studies
- Future work

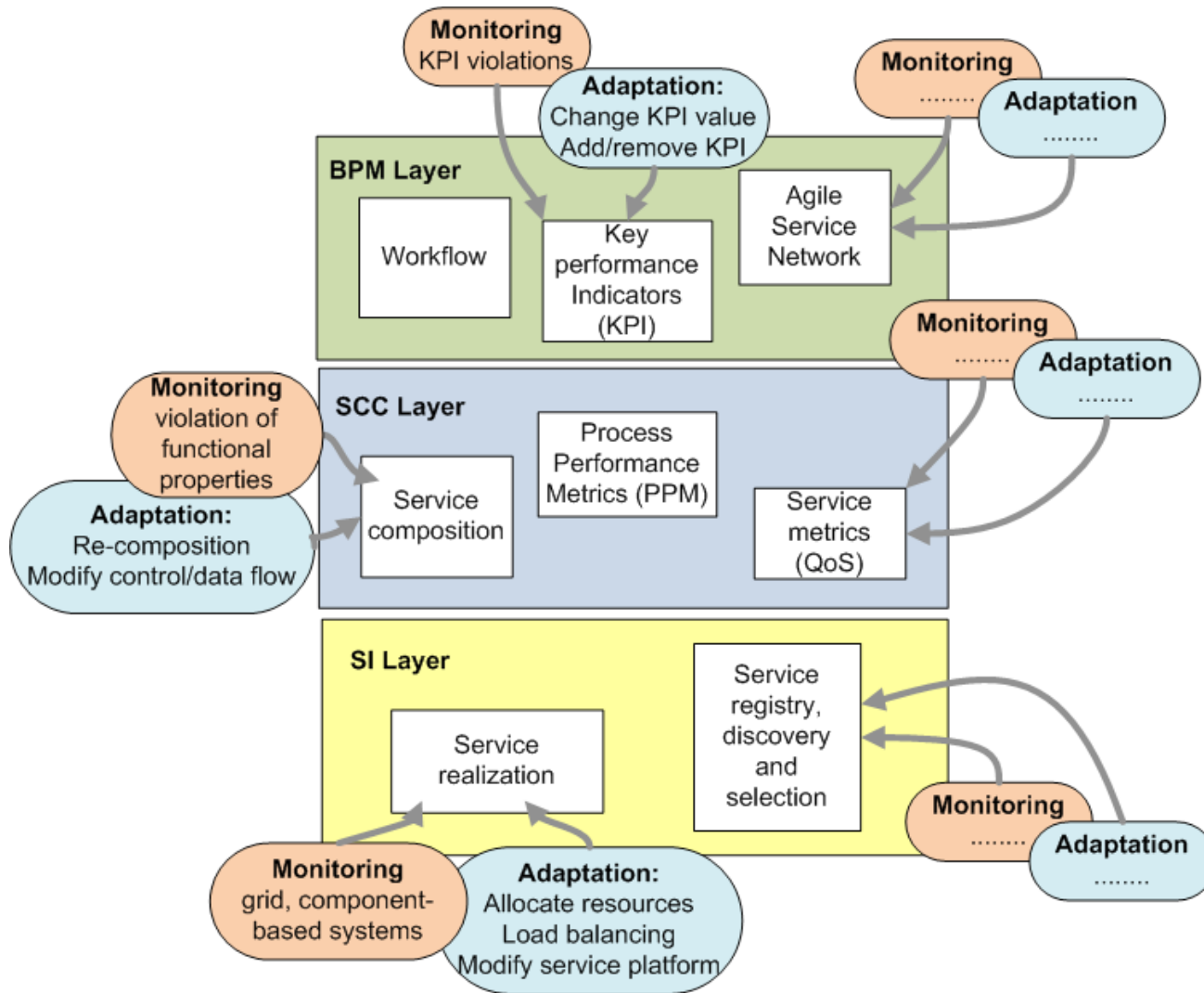
Service Based Applications

What is a SBA?

- SBA is an application that
 - has well-defined business goals
 - cannot be implemented by a singular service,
 - but requires the aggregation of multiple singular or composite services in a network
- SBA has three functional layers
 - Business Process Management
 - Service Composition and Coordination
 - Service Infrastructure

Adaptation and Monitoring in SBAs

What is missing?



Current approaches on monitoring and adaptation:

- fragmented
- isolated
- targeting particular part of SBA

Causing lack of:

- alignment of monitored events
- adaptation effectiveness
- adaptation compatibility
- adaptation integrity

So we need:

Cross-layer Adaptation and Monitoring Framework

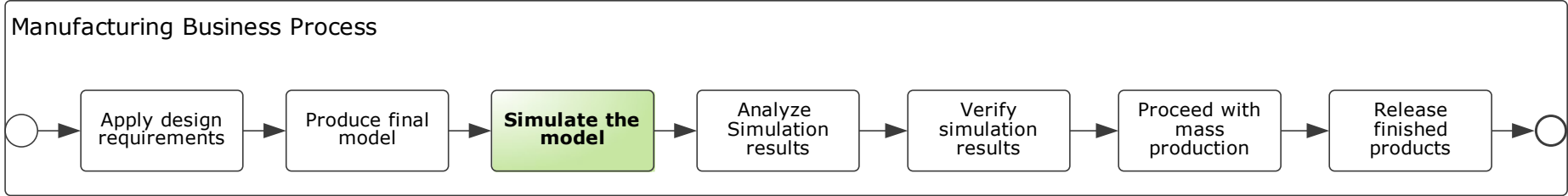


Why do we need a cross-layer approach?

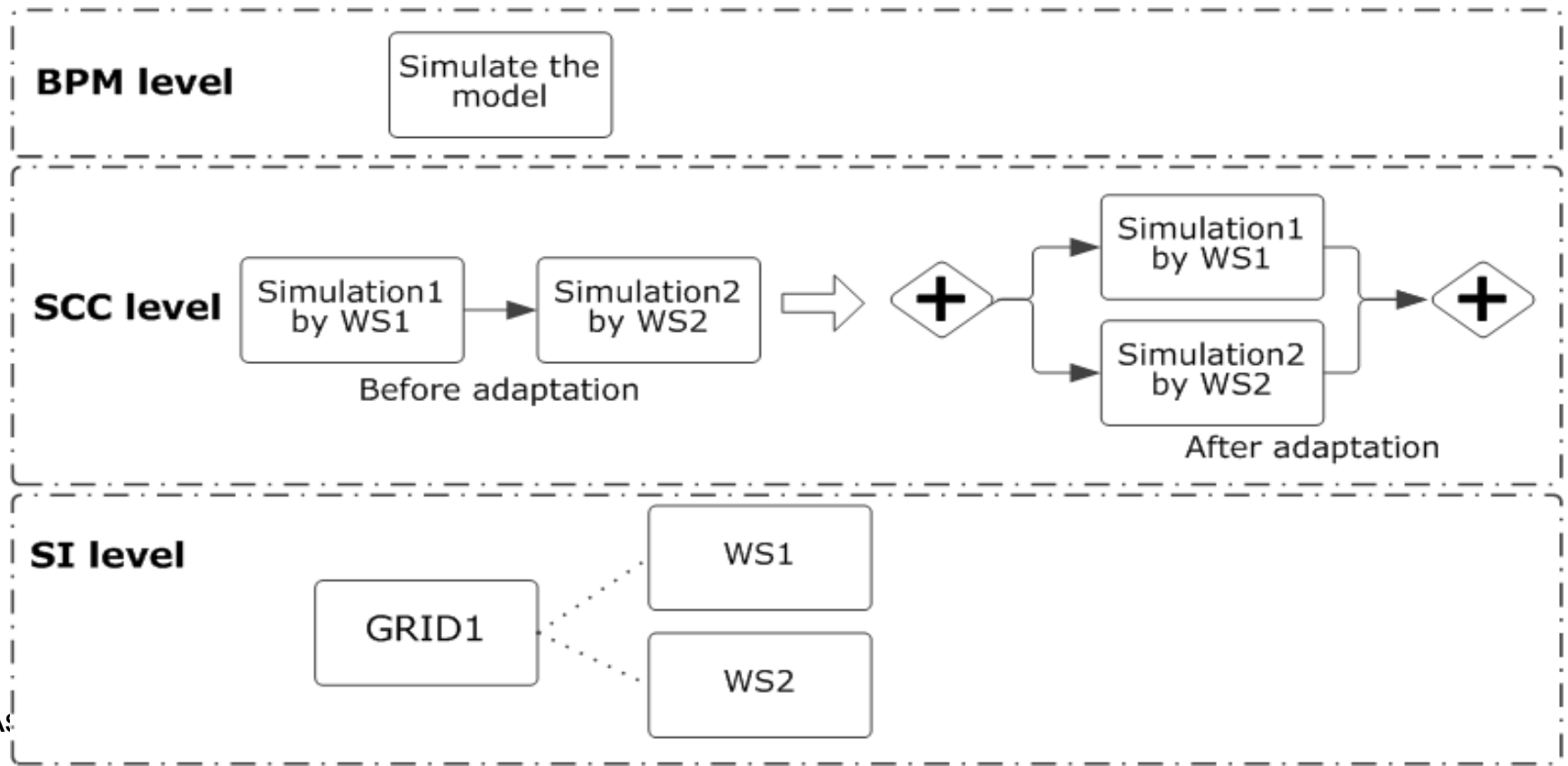
Problems...

- **Lack of alignment of monitored events:**
 - **Adaptation requirement is identified in a wrong layer.**
- **Lack of effectiveness:**
 - **Adaptation action is useless** because an important requirement on adaptation has not been considered.
- **Lack of compatibility:**
 - **Adaptation action is harmful** because it prevents the proper functioning of another layer.
- **Lack of Integrity:**
 - **Adaptation action is incomplete** because it is not reflected to the relevant layers accordingly.

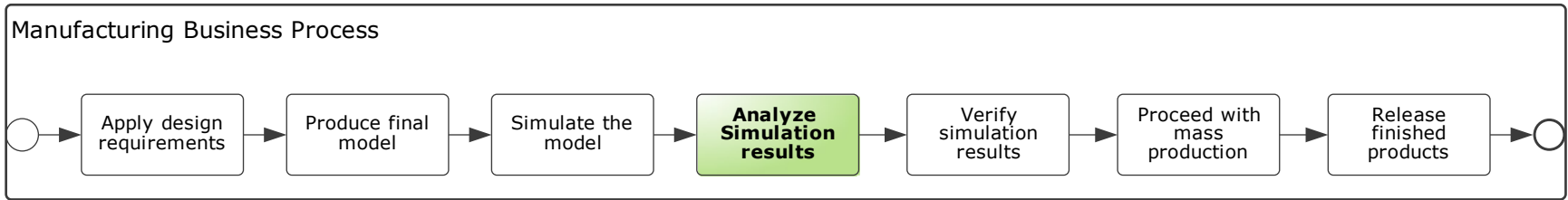
Lack of Effectiveness



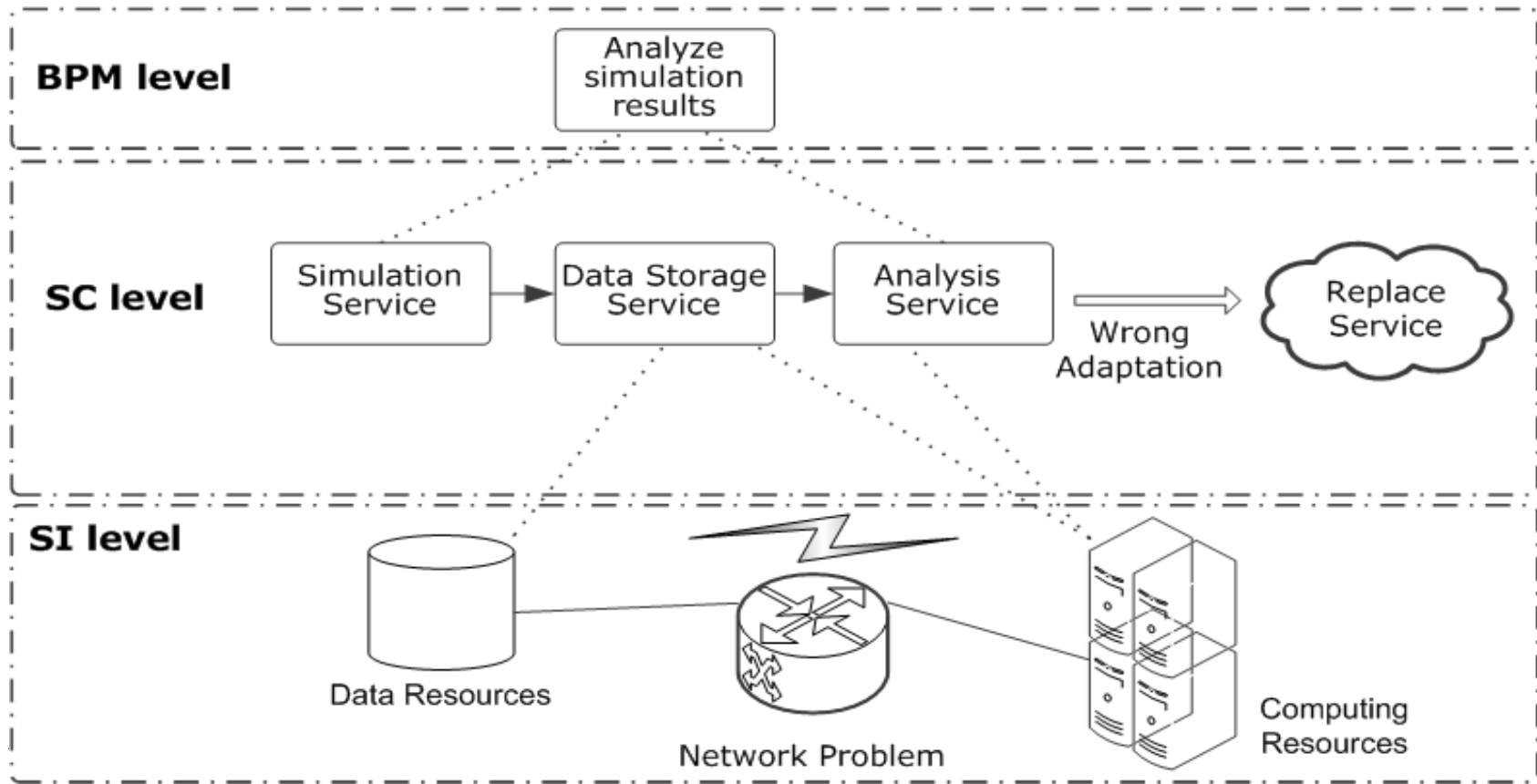
Monitored event: KPI value for average duration of simulations is not met (it takes too much time to complete simulation runs).



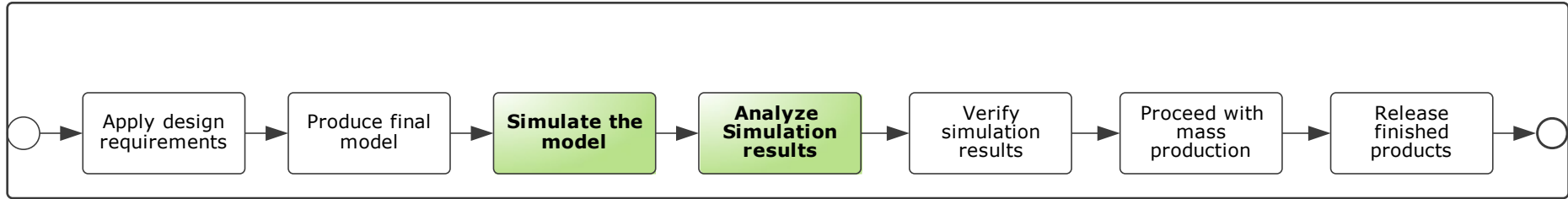
Lack of Alignment of Monitored Events



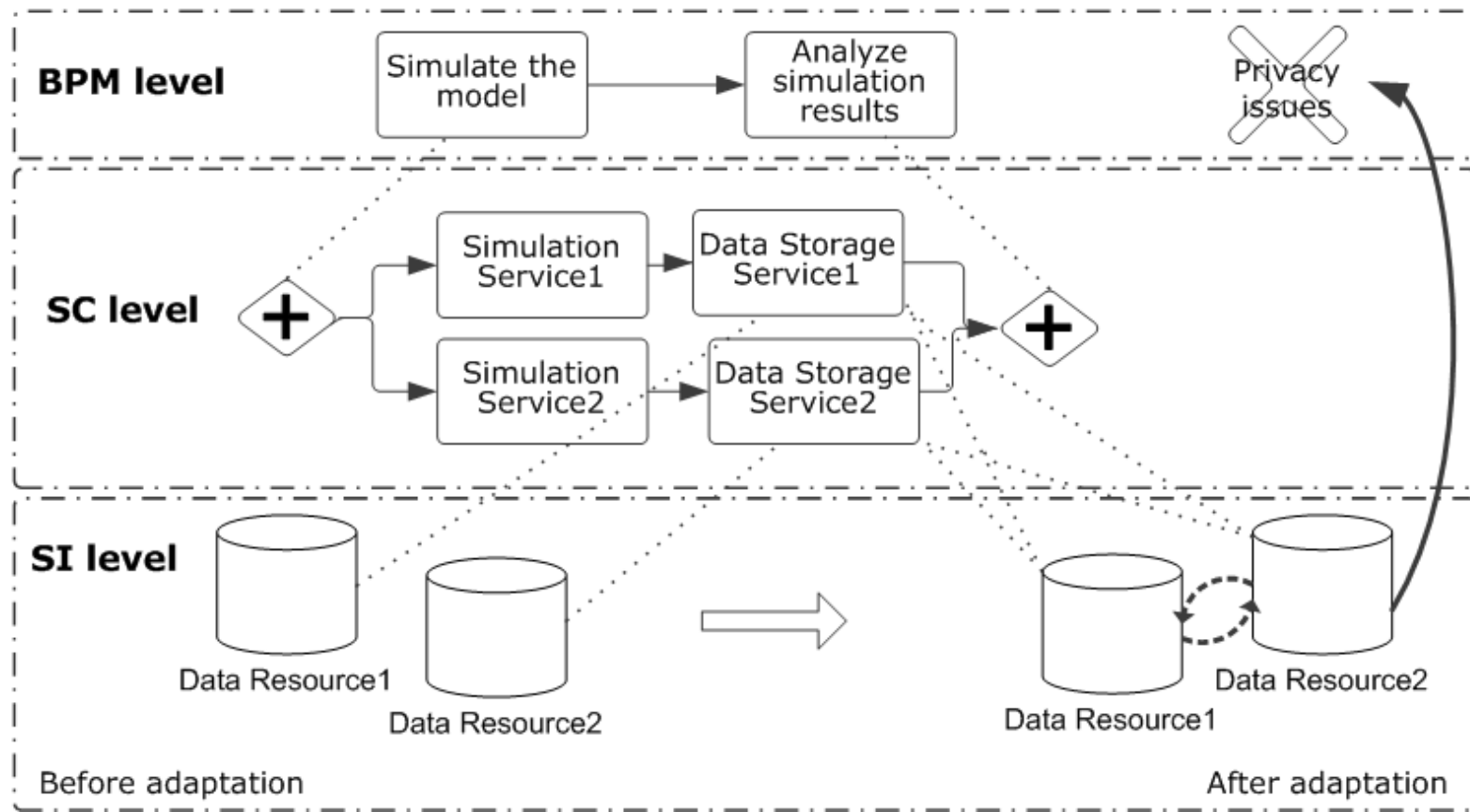
Monitored event: A problem in “analyze simulation results” activity. Results are produced too slowly.



Lack of Adaptation Compatibility

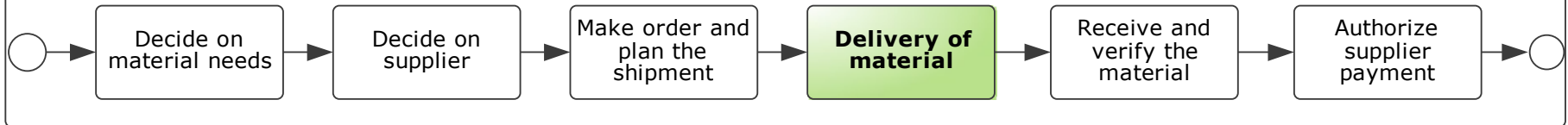


Monitored event: QoS value is not met due to the unavailability of some of the storage resources.

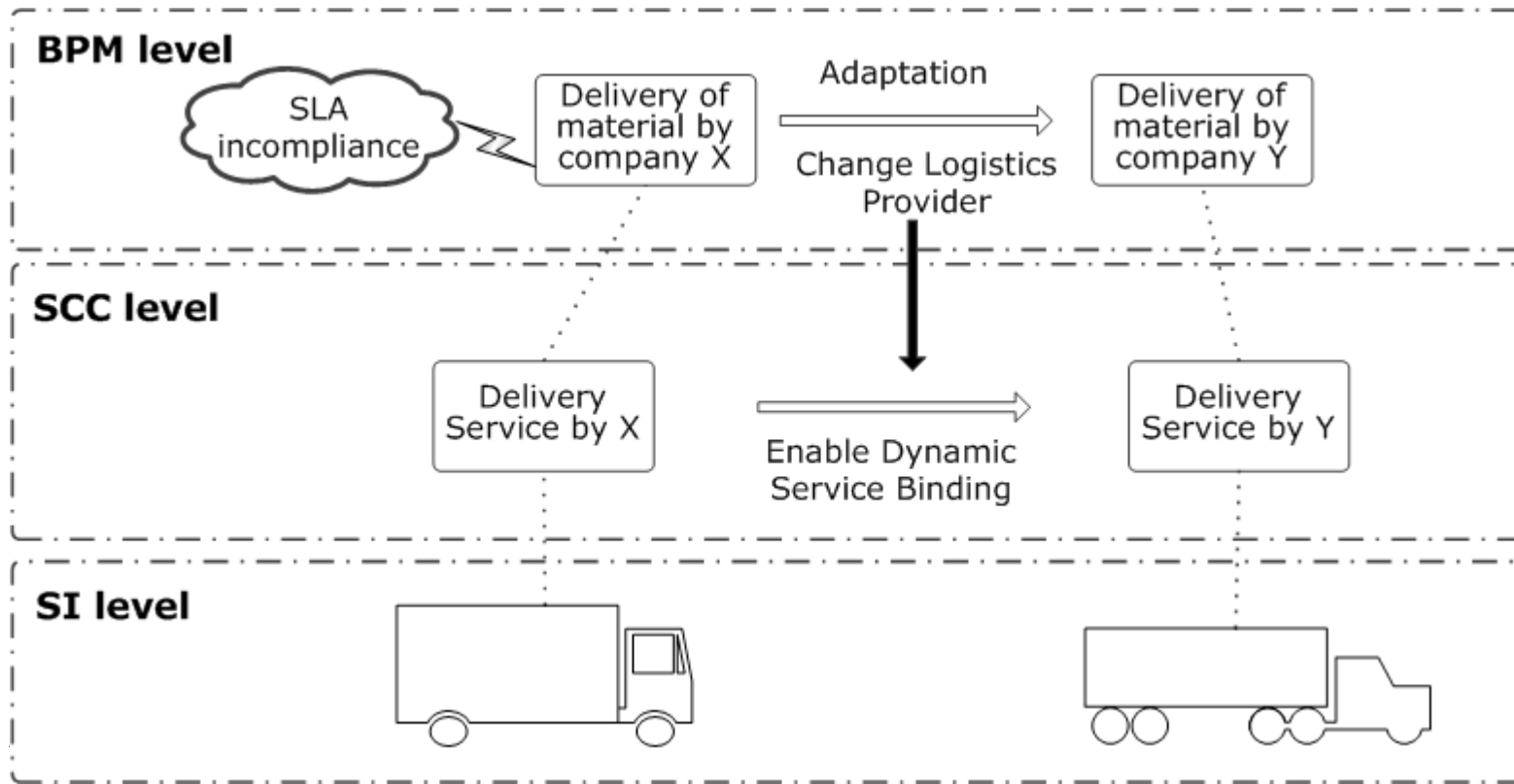


Lack of Adaptation Integrity

Plan and Purchase Materials from Suppliers Business Process



Monitored event: Logistics provider company (responsible for delivery of material) does not comply with SLA.

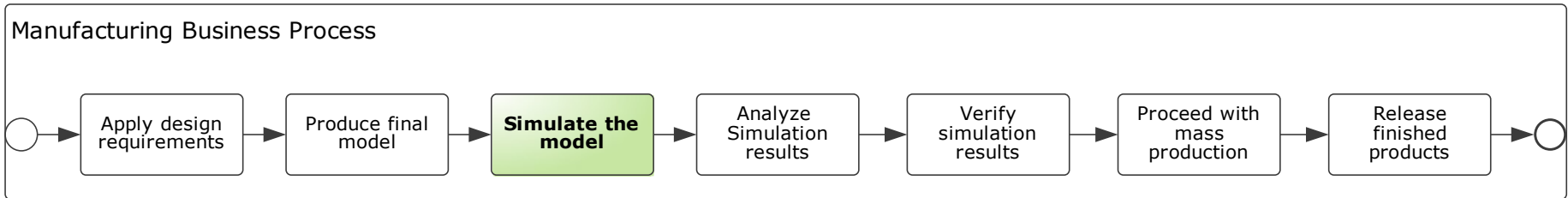


How to solve these problems?

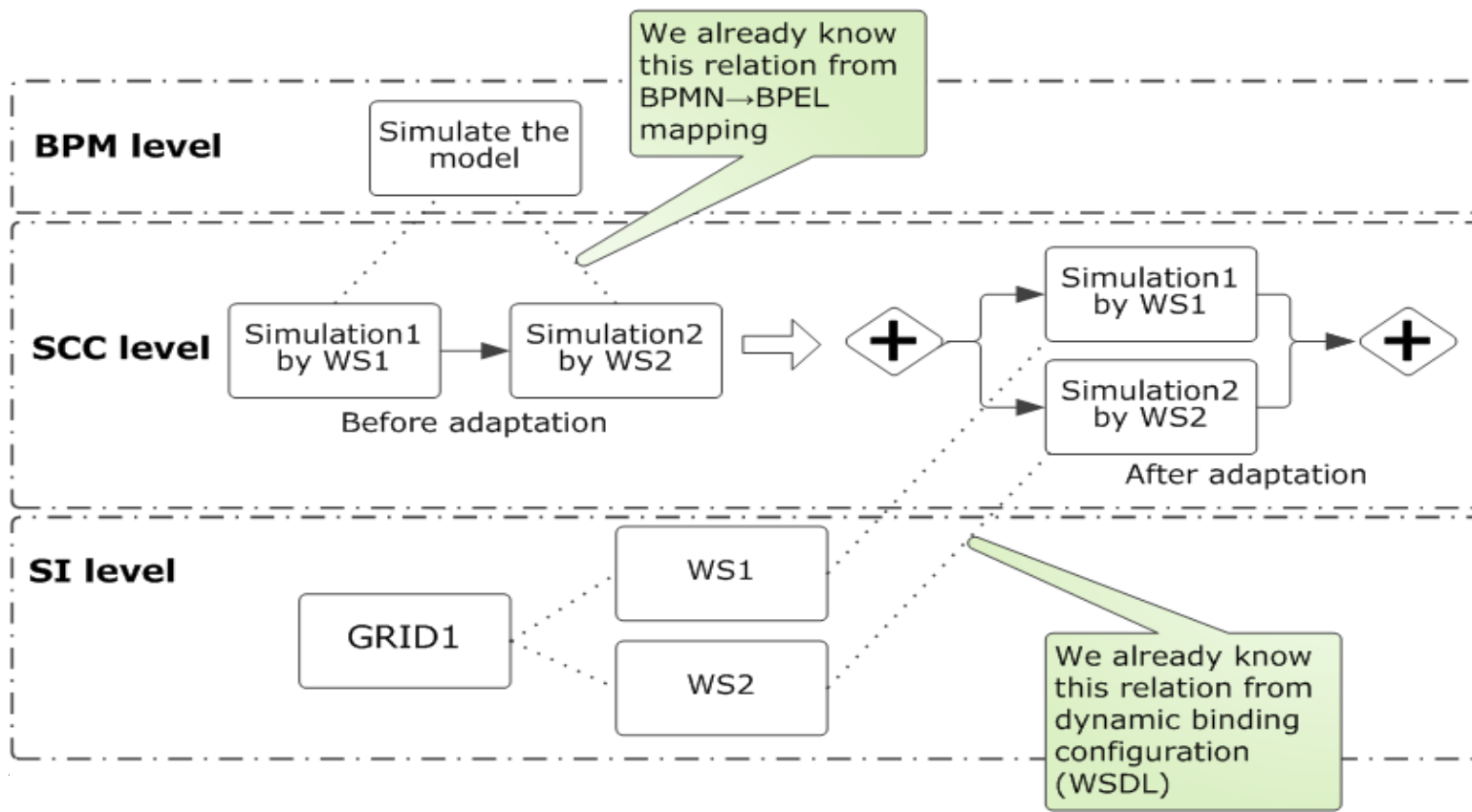
- We need a centralized, high-level framework:
 - *to perform adaptation and monitoring in a coordinated manner*
 - *to control and manage isolated layer-specific tools*
- This framework should make use of already existing cross-cutting aspects of the SBA.
- Instances of this framework can vary depending on
 - *different application domains*
 - *different adaptation and monitoring cases*

An illustrative instance of the framework:
*a sample cross-layer solution for one of the
case studies*

Recalling the case study...



Monitored event: KPI value for average duration of simulations is not met (it takes too much time to complete simulation runs).



Sample Solution for the Case Study

Case 1:
WS1 and WS2
use the same
grid resource
after adaptation.

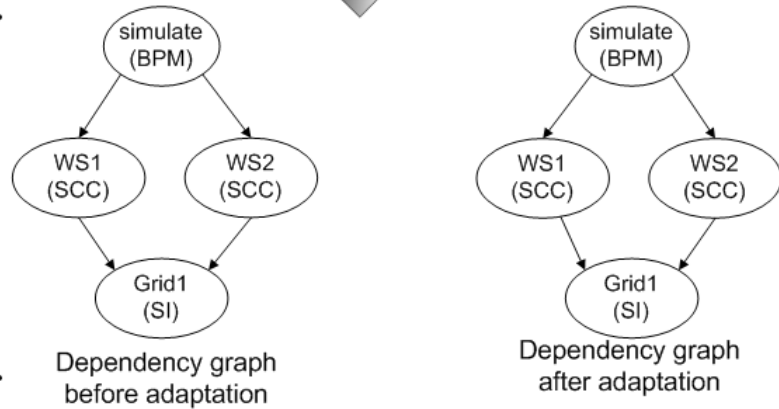
Representation of SBA elements

BPM level:
business activity →activity.name = simulate

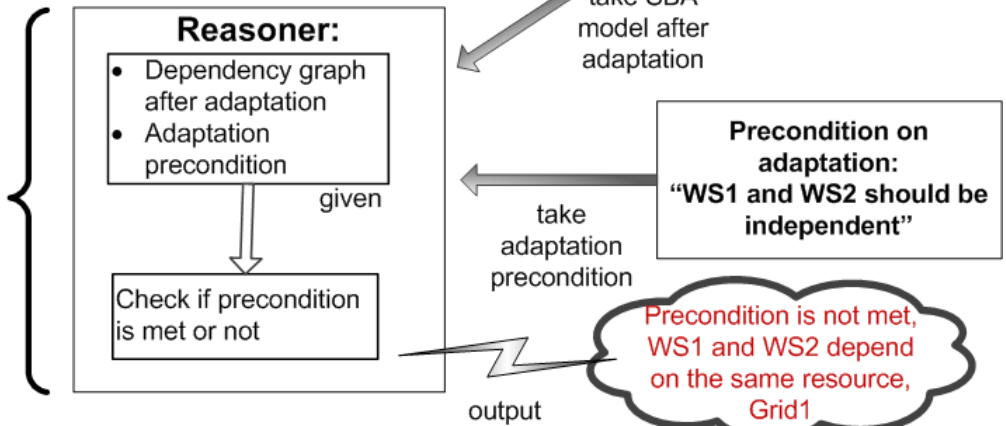
SCC level:
composition scope →scope.service = WS1
scope.service = WS2
scope.type = sequential (parallel)

SI level:
resource →resource.name = grid1

Cross-layer SBA model

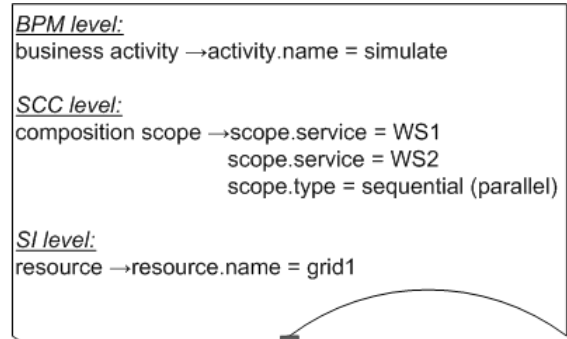


Cross-layer adaptation handler

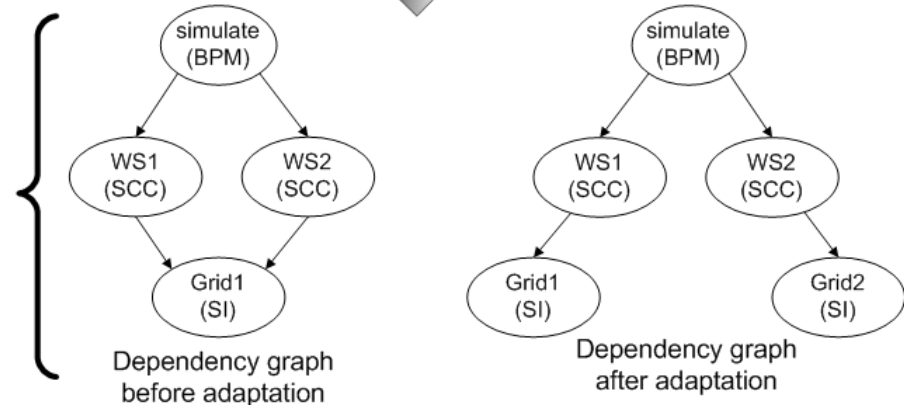


Sample Solution for the Case Study

Representation of SBA elements

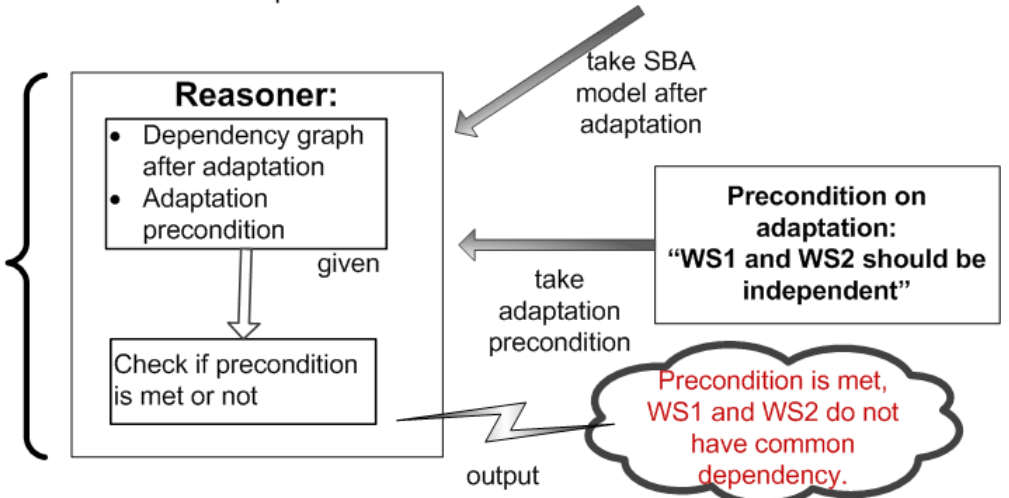


Cross-layer SBA model



Case 2:
WS1 and WS2
use different
grid resources
after adaptation.

Cross-layer adaptation handler



Future Work

- Implement cross-layer solutions for different case studies
 - lack of alignment of monitored events
 - lack of effectiveness
 - lack of compatibility
 - lack of integrity
- Based on the feedback from case studies
 - consolidate the cross-layer adaptation and monitoring framework
- Make use of the framework for
 - cross-layer quality assurance for adaptation

Thank you!

Any questions or comments?