Event Stream Processing Units in Business Processes

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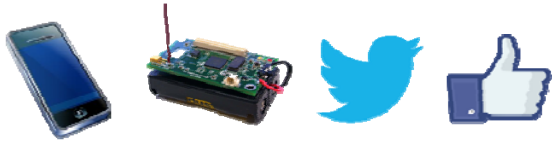
Event Stream Integration enhances Business Processes

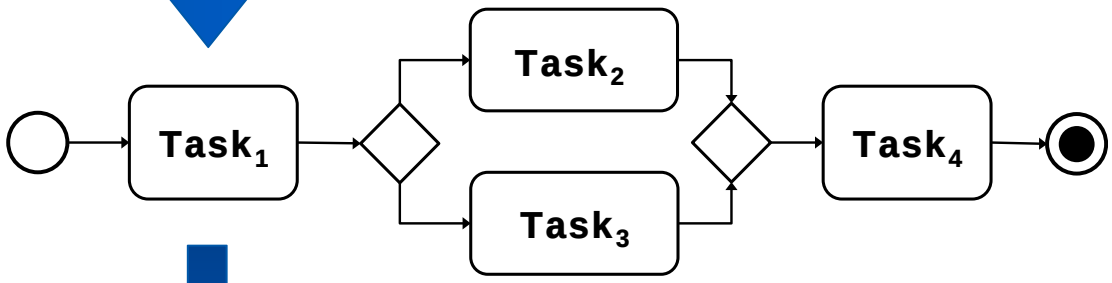


- Event Streams are ubiquitous
- Integration of real world feedback in business processes:

→ Enhanced processes

→ New business cases

- *Example*: Logistics process with shipment monitoring



BPM World and the Event-based World

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BPM World

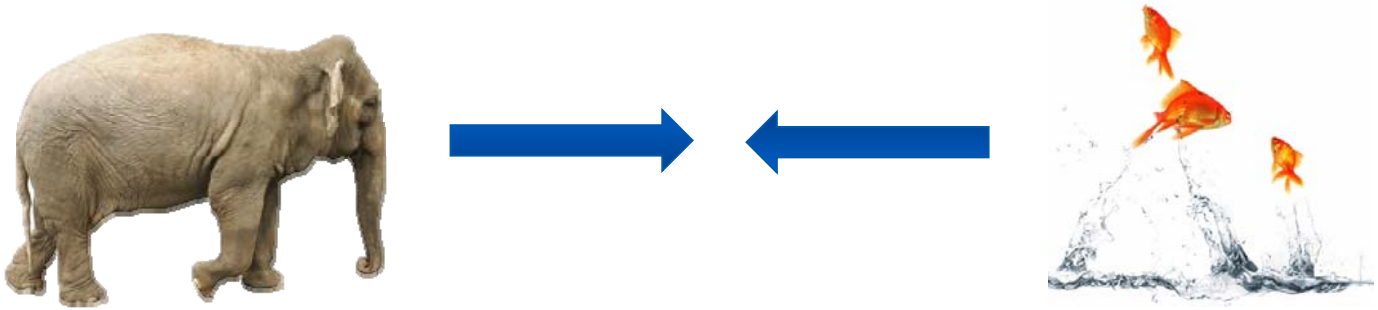
- Structured business processes
- Top-down view
- Pull-based approach with explicit invocation

  SOA, Databases, ERP, etc.
- Data processing: Request/reply

Event-based World

- Real-time data streams consisting of events
- Bottom-up view
- Push-based approach with implicit invocation

  Complex Event Processing etc.
- Data processing: Reactive and asynchronous (pub/sub)



Integration of Event Stream Processing in BPM Workflow

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BP Modeling (BPMN)

Transition

BP Execution (BPEL)

Interaction

IT Infrastructure (SOA)

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Business Functions: Coherent Abstraction across Layers

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BP Modeling (BPMN)

BPMN Task

BP Execution (BPEL)

Service Invocation

IT Infrastructure (SOA)

Web Service

Business Function

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Event Stream Processing Encapsulation as Business Function

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- **Event Stream Processing Unit (SPU):**
  Container for event stream processing at the abstraction level of a business function
- Main SPU characteristics across layers:
  - Implicit invocation possible (triggered by event)
  - Continuous operation
    → no request/reply
    → requires implicit and explicit completion
  - Input data not known at invocation
    → publish/subscribe
- Need to be addressed across the modeling, execution, and IT layer

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SPU Realization across Layers

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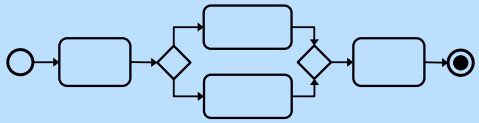
1. Modeling Layer

- BPMN notation for SPUs
- Execution semantics for continuous operation
- Data streams as input and output



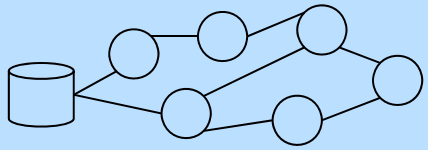
2. Execution layer

- Process execution control flow with support for implicit and explicit invocation
- Data input as subscriptions to events

```
<process name="pns:Caller">
  <invoke partnerLink= "Link">
    <service name="wns:Billing" />
  </invoke>
</process>
```

3. IT Layer

- Service-like container model to encapsulate event stream processing as business functions



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1. Modeling Layer: BPMN 2.0 Extension

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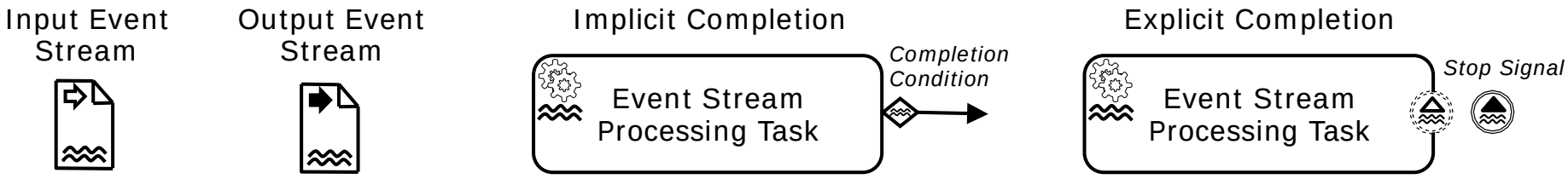
- Event Stream Specification (ESS)
  - Input Event Stream → Subscription
  - Output Event Stream → Advertisement
- Event Stream Processing Task (ESPT)
  - Continuous operation
  - Explicit completion: triggered externally via signal
  - Implicit completion: evaluated internally



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1. Modeling Layer: Task with Explicit Completion

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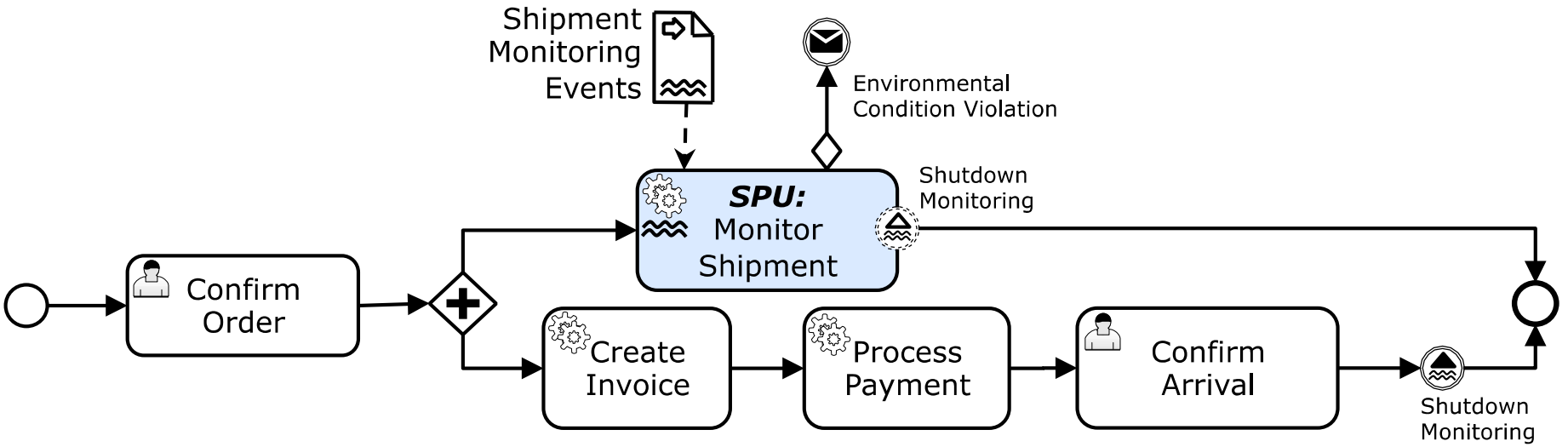
- ESPT completion triggered by signal from within process
  - Responsibility of process execution engine
  - Completion when event processing is known to be not required anymore
  - Completion is controlled, e.g., persisting data, closing connections



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1. Modeling Layer: Task with Implicit Completion

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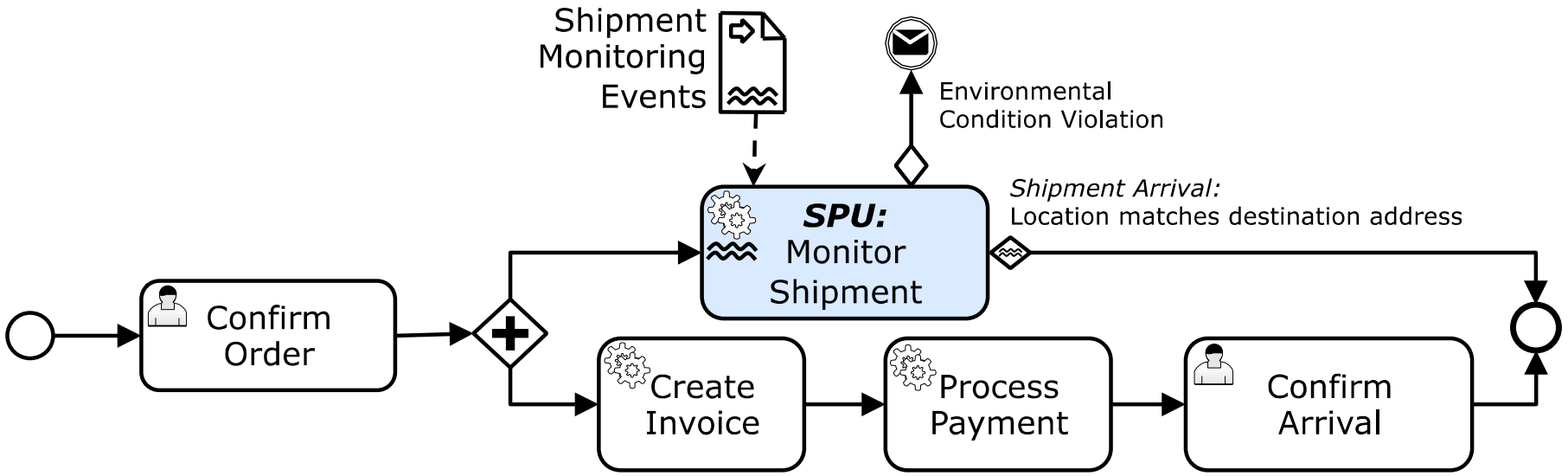
- ESPT completion triggered from task application logic implementation
  - Responsibility of IT infrastructure
  - Completion when condition is met (timeout, event pattern, etc.)
  - Back channel to process execution engine



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2. Execution Layer: Runtime View

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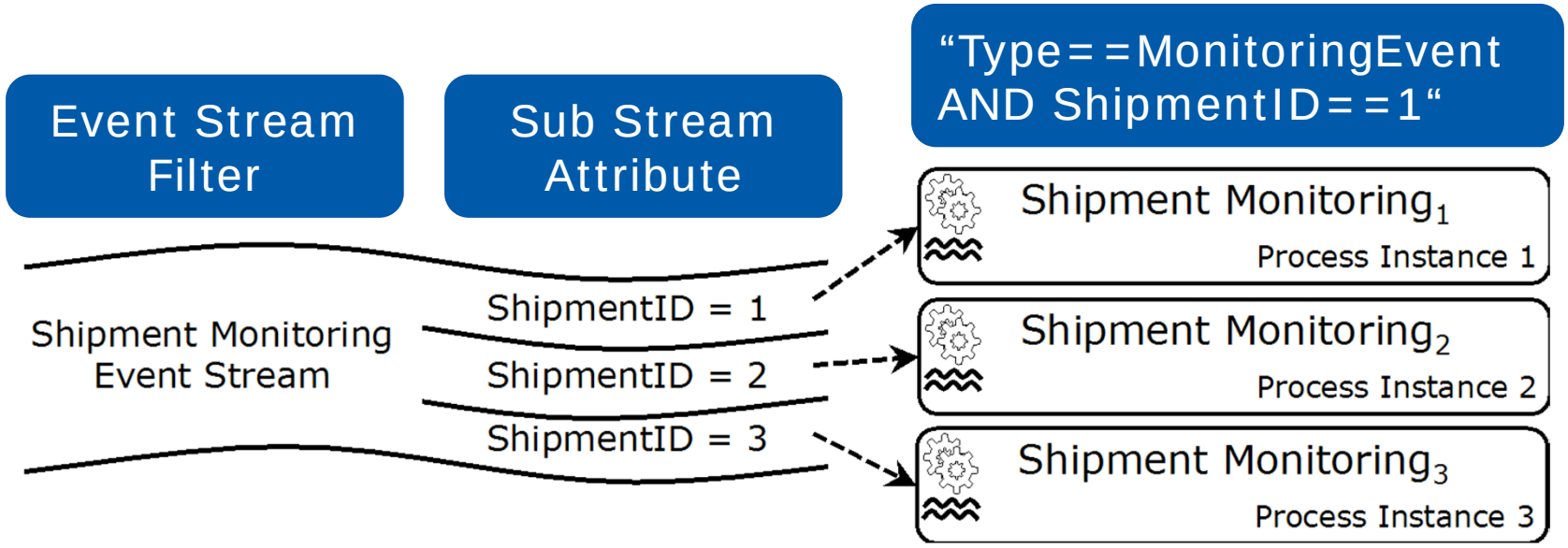
- Event stream processing unit instance per entity instance (e.g., per shipment)
  - At execution layer, specification of SPU input to derive subscription
  - *Event Stream Filter:* General filter, applies to all SPU instances
  - *Sub Stream Attribute:* Identifies entity instance event streams



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3. IT Layer: Eventlets as service-like containers for event stream processing

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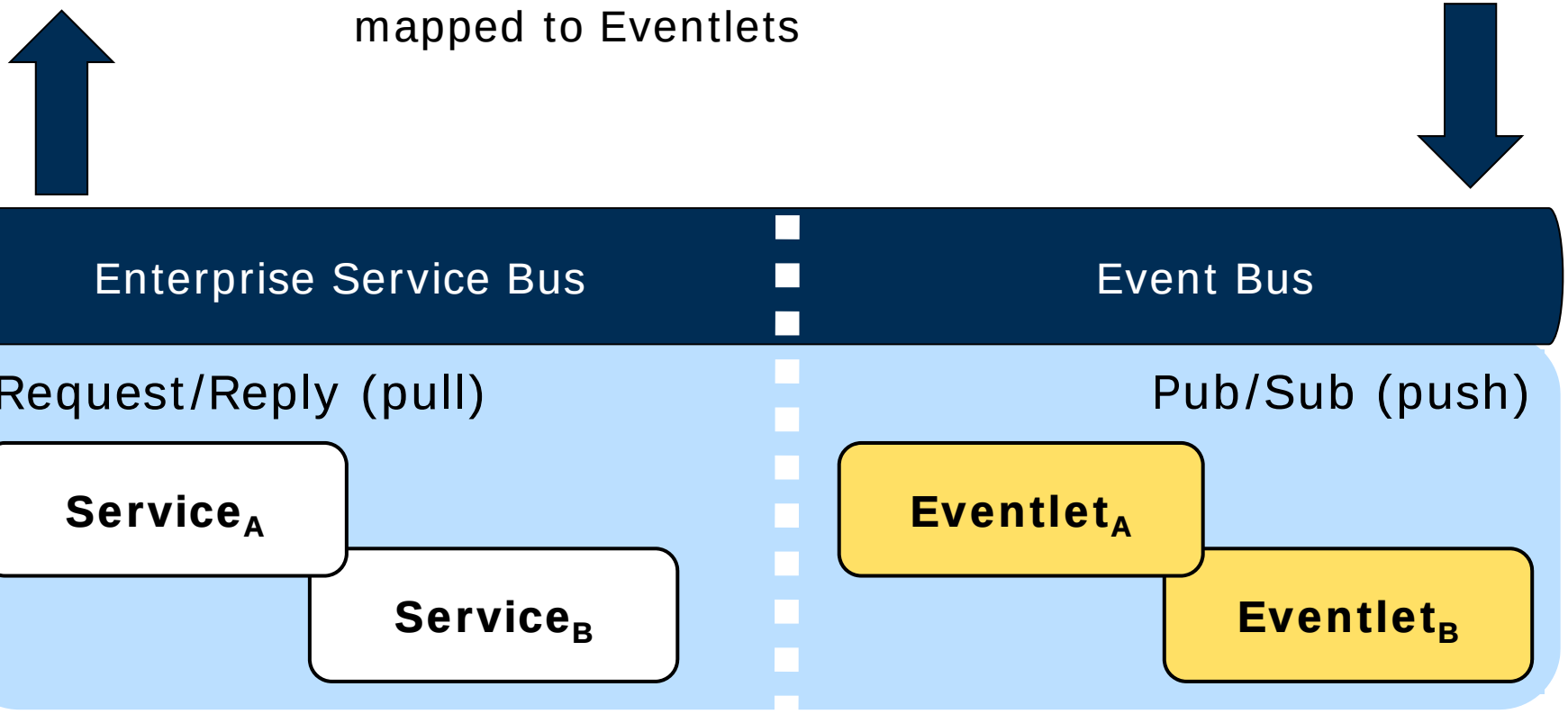
- Service Tasks are mapped to web services
- Event Stream Processing Tasks are mapped to Eventlets



3. IT Layer: Shipment Monitoring Example

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Shipment Monitoring

Eventlet Metadata

CompletionCondition:	*Timeout(120sec)*
EventStreamFilter:	*MonitoringEvent*
SubStreamAttribute:	*ShipmentID*

<Shipment42>

Eventlet Runtime Code

```
onInstantiation(subStreamId id) {
 limit = getTempThreshold(id); }

onEvent(Event e) {
 if (e.getValue("temp") > limit)
     raiseAlert(); }

onRemove() {}
onCompletion() {}
```

Conclusion

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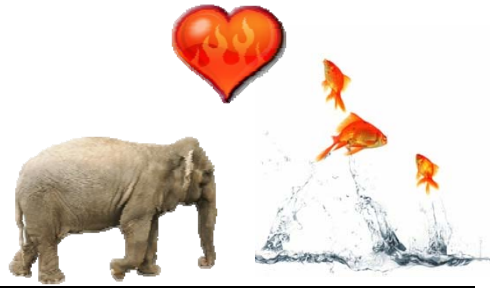
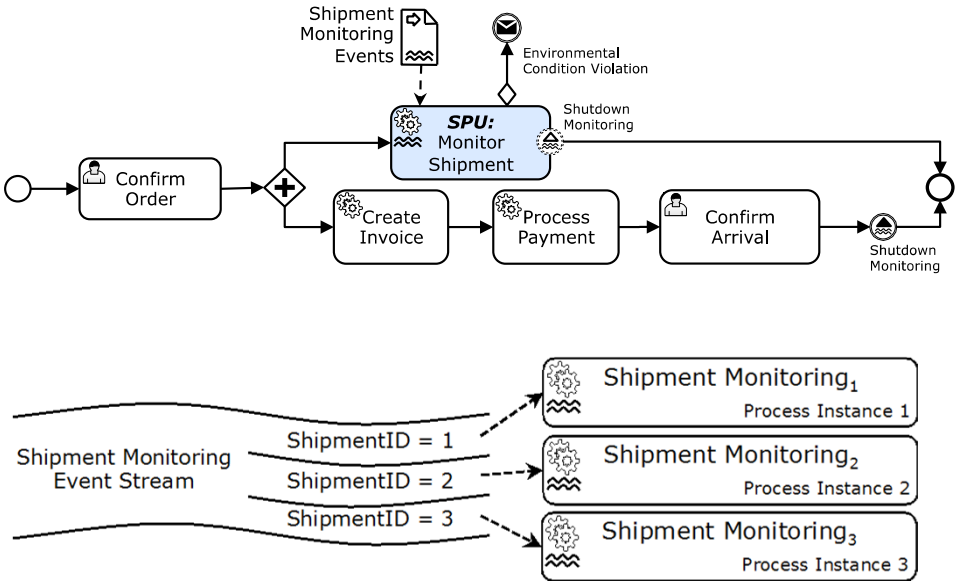
- **Event Stream Processing Units (SPUs)** encapsulate event stream processing as business function
- SPUs ensure a high coherence across modeling, execution, and IT layer
- SPUs at modeling layer: **Event Stream Processing Tasks** as BMPN extension with implicit and explicit completion semantics
- SPUs at execution layer: Support of implicit and explicit instantiation by process execution engine
- SPUs at IT layer: **Eventlets** – Container model for event stream processing



Questions and Comments



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Overview

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- Event stream processing and business processes management
- Event stream processing units (SPUs): Encapsulation of event stream processing
- Integration of event stream processing:
  - Business process modeling
  - Business process execution
  - Enterprise IT infrastructure

Execution layer: Mapping from Model to Execution

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- "Event compatible" equivalent to service invocation
- Explicit instantiation: Triggered when control flow reaches task

  `EsptInstantiate(MonitorShipment, MonitoringEvent, ShipmentId, 42)`
- Implicit instantiation: Data provided at registration of process model

  `EsptRegister(MonitorShipment, MonitoringEvent, ShipmentId)`
  - Automatic creation of SPU instances and synchronization with execution engine

Subscription example:

"Type==MonitoringEvent AND ShipmentID==42"