Who is TIBCO?

We provide enterprise infrastructure software that enables real-time awareness, understanding and action.

We help customers...

- **Accelerate** IT projects
- **Increase** operational efficiency and effectiveness
- **Improve** operational visibility, collaboration and ability to be proactive
## What are we helping Customers handle?

### Process Cycle-Time Improvements

<table>
<thead>
<tr>
<th>Task</th>
<th>Timeframe 1</th>
<th>Timeframe 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform Trading Analytics</td>
<td>30 minutes</td>
<td>5 seconds</td>
</tr>
<tr>
<td>Airline Operations</td>
<td>20 minutes</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Handle Call Center Inquiries</td>
<td>8 hours</td>
<td>10 seconds</td>
</tr>
<tr>
<td>Track Financial/Risk Position</td>
<td>1 day</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Supply Chain Updates</td>
<td>1 day</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Document Transfer</td>
<td>3 days</td>
<td>20 seconds</td>
</tr>
<tr>
<td>Phone/Service Activation</td>
<td>3 days</td>
<td>1 hour</td>
</tr>
<tr>
<td>Refresh Data Warehouse</td>
<td>1 month</td>
<td>1 hour</td>
</tr>
<tr>
<td>Settle Trade/Transaction</td>
<td>5 days</td>
<td>1 day</td>
</tr>
<tr>
<td>Build-to-Order Product</td>
<td>6 weeks</td>
<td>1 day</td>
</tr>
</tbody>
</table>

Source: Gartner
Who TIBCO helps

47 of the World’s 100 Largest Companies are TIBCO Customers

- Investment Banking — 9 of top 10
- Retail Banking — 17 of top 20
- Telecommunications — 8 of top 10
- Hi-Tech Manufacturing — 15 of top 20
- Pharmaceutical — 6 of top 10
- Manufacturing (non High-tech) — 5 of top 10
- Consumer Package Goods — 5 of top 10
- Energy — 5 of top 10
- Transportation — 4 of top 10

* By annual revenues except for investment banking which is measured by assets
How TIBCO Organizes IT Solutions

- Increase operational efficiency and effectiveness.
- Accelerate projects, initiatives, and go-to-market cycles.
- Improve operational visibility, collaboration and ability to be proactive.
- Service-Oriented Architecture
- Business Process Management
- Business Optimization

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1. From Messaging to Event Processing

2. Event Processing vs CEP

3. Complex Event Processing – Who and When

4. CEP Evolution and Trends

5. Some Customer Examples

6. Future research topics
Networking – a brief history

Military, large systems
High cost
Low re-use

Financial investment etc systems
High cost
High value

Internet era starts, Pub-sub
Low cost
Commodity

Custom Messaging / communications

Generic Messaging + application communications

1960s 1970s 1980s
Messaging – a brief history

1968 - Arpanet

1974 - TCP

1984 – Internet to TCI/IP

1985 – Teknekron

1986 – Banking Middleware

1991 – CORBA

2001 – JMS

Generic Messaging + application communications

Custom Messaging / communications

1960s  1980s  1990s

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TIBCO MOM – example of commercial MOM

- **TIBCO Enterprise Message Service (EMS)**
  - Server-based store and forward
  - J2EE and .NET

- **TIBCO Rendezvous (RV)**
  - Peer-to-peer distributed
  - Multicast

- **TIBCO SmartSockets**
  - Server-based messaging used in exchanges

- **TIBCO Hawk**
  - Management framework for systems
1980s: commercial m/w
- 1985 Teknekron Software Systems founded
- 1987 Teknekron acquired by Reuters PLC; expanded use in financial services clients

1990s: distributed systems
- 1994 Teknekron acquired by Reuters PLC; expanded use in financial services clients
- 1996 Application Monitoring
  - 1st to support HTTP, FTP, SMTP, SNMP
- 1998 Full-featured Workflow
  - Single Solution for EAI & B2B
- 1999 Portal
  - XML Schema Mgmt
- 2000 EJB Adapter and full J2EE Support
- 2001 Sophisticated XML & Web Services, BusinessWorks
- 2002 BAM
  - HIPAA and HL7 Support
  - ebXML Support
- 2003 EM Advisor
  - Enterprise Messaging
- 2004 ENS
  - EMS
  - ESB
  - TIBCO revises Reuters relationship
- 2005 Over 1000 ESB customers

2000s: standards
- 2001 Sophisticated XML & Web Services, BusinessWorks
- 2004 EJB Adapter and full J2EE Support
- 2005 ENS
- 2006 EMS
- 2007 TIBCO revises Reuters relationship

2000s: m/w exploitation eg SOA, BPM, CEP
- 2006 EJB Adapter and full J2EE Support
- 2007 Sophisticated XML & Web Services, BusinessWorks
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Simple Event Processing

New Order

Business Process (BPM)

IT Services (SOA)

Database
Multiple Simple Event Processing

- New Order
- Cancel Order
- New Supplier
- SLA Chk Req

- New Order Process
- Cancel Order Process
- etc
- etc

IT Services ...

Database
Complex Event Processing

(Lots of Events)

Continuous Event Processing

(Complex) Event Patterns

Workflow Processes (BPM)

Event Store

IT Services (SOA)
Production Item Arrives at Store
Customer Logon
Fed Base Rate Increase
New Liability Added
Rental Car Crashed
Customer Checks
Close Account
Web Page
Mobile Call from CT @11.13
Rental Car Returned
Contract Submitted
Contract Returned thru EDI
New Order
Complex Business Problems

- **Fraud / Theft**
  - Thousands-to-millions of high-value small-size product items or transactions
  - How do you identify known patterns of “suspicious” behavior?

- **Logistics / Scheduling**
  - Raw material, production & delivery scheduling and resources are complex and prone to change
  - How do we reallocate resources to handle business and production changes?

- **Activity Monitoring**
  - Complex production and supply process with multiple actors
  - How to measure and action Key Performance Indicators?
Associated Events

- **Positive Events**
  - Product item X arrives at Production station S from Store T
  - Production worker Y arrives at Production station S
  - Production contract for item Z by time T is posted

- **Negative Events**
  - Product item X has been in transit to Store T for >15 minutes
  - Subcomponent Y hasn’t arrived at the Production station by the ETA
  - Delivery of contract Z has not taken place

- **Sets of Events**
  - 5+ items of Product item type Y failed to arrive at destination
  - Supplier Y was 5 mins late for 1 delivery, but made it early to the next
  - Return rate on component Z exceeds SLA %
Significant features of these Events

- **Time Sensitivity**
  - A thief may leave the building at the same time as stolen product
  - A product should take 40 minutes to travel a given production line segment

- **Distributed Event Sources**
  - A series of produced items fails at various QA stages, and their common attribute was a storage location
  - Multiple suppliers for a subcomponent are reporting delivery delays

![Diagram with arrows connecting ERP and Supplier]
TIBCO Software Stack

Complex Event Processing

- CEP
  Eg TIBCO BusinessEvents

Simple Event Processing

- BPM / Workflow
  Eg TIBCO iProcess

- SOA Support
  Eg TIBCO ActiveMatrix, BusinessWorks, …

- Visual BI
  Eg TIBCO Spotfire

Middleware / Enterprise Service Bus

- Eg TIBCO Rendezvous, TIBCO EMS (JMS)
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CEP – a brief history

- Military, Logistics etc systems
  - High cost / analog
  - Low re-use

- Financial investment etc systems
  - High cost
  - High value

- Commercial systems
  - Lower cost
  - ROI

1960s 1990s 2000s

Generic CEP tooling

Custom CEP implementations
Military Sensor Data Fusion as Custom CEP

![Diagram](image)

**Event Sources**
- External
- Distributed
  - Local
  - Event Services
  - Event Profiles
  - Data Bases
  - Other Data

**Event Pre-Processing**
- Level One: Event Refinement
- Level Two: Situation Refinement
- Level Three: Impact Assessment

**Level Four**
- Process Refinement
- DB Management
  - Historical Data
  - Profiles & Patterns

**Decisions**
- Filter
- Join
- React
- Decide

Adapted from JDL:

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Generic CEP Architecture

Event Bus or Source
- Low-latency reliable message delivery

Event and Data Model
- for information modeling

Temporal Model
- for determining time-dependent info

Pattern Detection Model
- for recognizing patterns, defining actions

History and Cache
CEP - Marketshare, by #Customers

Reported CEP Customers to 2009

Number of Customers

Year


IBM, Oracle, Streambase, Aleri & Coral8, Apama, TIBCO
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Example CEP Evolution: TIBCO BusinessEvents

- **BE 3.0**
  - Business User Interface
  - Query support
  - Shareable Cache
  - Distributed model

- **BE 1.4**
  - AIX deploy

- **BE 1.3**
  - BW Designer
  - (SOA co-development)

- **BE 1.2**
  - Tester
  - HPUX deploy

- **BE 1.1**
  - Rule fns
  - XPath
  - Linux deploy

- **BE 1.0**
  - Complex Event Proc’ing
  - Win / Sol deploy

- **BE 4.0**
  - ????

- **BE 2.2**
  - BW runtime integration

- **BE 2.1**
  - Persistence control

- **BE 2.0**
  - Debugger
  - Analyser
  - API
  - Exceptions

Customer Project
- High performance event patterns

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Event-driven and continuous processing of events

Event Model
- **Events** read from **Channels** (eg custom, RV, EMS)
- **Payload, Metadata** (eg TimeToLive, expiry action)

Concept Model
- **Data Model** (eg UML Class model for fixed relationships)
Basics for CEP: Event Processing behaviour

- Complex event processing models: continuous correlations of events

High Performance CEP
- Event Processing models (eg code generation)
- “Event processing” includes detecting patterns across events, past events (data, event history), time, state…

Low Latency CEP
- In-Memory event and data store for maximum performance
CEP Model 0: Procedural Rule

Event Bus or Source
Low-latency reliable message delivery

Event and Data Model
for information modeling

Temporal Model
for determining time-dependent info

Pattern Detection Model
for recognizing patterns, defining actions

History and Cache

Trigger

Invoked / Programmed Reaction

Rule Function

Supported thru shared libraries, etc

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CEP Model 1: Production Rule-oriented

Event Bus or Source
- Low-latency reliable message delivery

Event and Data Model
- for information modeling

Temporal Model
- for determining time-dependent info

Pattern Detection Model
- for recognizing patterns, defining actions

History and Cache

(Lots of Events)

Patterns

Reaction

Rule
Rule-driven CEP for complex patterns, decisions

Knowledge-driven CEP
- Inference Rule Engine for
  - event-condition-action
  - Infering new events
  - Working across multiple events and data in memory

CEP Rule Elements
- Inference Rule Engine
- Rulebase

CEP Tool
- Event Sources
- Event Sinks
- Event Bus
- Event Model
- Class Model
- Libraries
- Local Event Store

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Inference Rule CEP Agent features

1. **High performance pattern matching**
   - Eg Rete algorithm determines rules that are executable based on underlying data changes

2. **Declarative + Inferencing**
   - Rules defined in terms of classes: can be relevant for any # instances
   - Rules’ actions can cause other rules to fire automatically

3. **In-memory**
   - Limited only by JVM / process memory
CEP Model 2: State-oriented

- Event Bus or Source
  - Low-latency reliable message delivery

- Event and Data Model
  - for information modeling

- Temporal Model
  - for determining time-dependent info

- Pattern Detection Model
  - for recognizing patterns, defining actions

- History and Cache

Condition / TimeEvent

State Model

State 1 → State 2
Modeling complex event lifecycles with states

- **Dynamic State for CEP**
  - **State Machine** for event lifecycle modeling via states and state transition rules

CEP State Elements

Event Sources

Event Bus

State Engine

State Model

CEP Tool

Event Sinks

Event Model

Class Model

Libraries

Local Event Store

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State Model / Process Flow CEP Agent features

1. Visual modeling metaphors
   - Eg State diagram / flow diagram is simple to follow; UML standard

2. State / flow transitions can be time-related
   - Can model missing events through time-outs etc

This yields significant savings by eliminating driver man hours wasted waiting at the border. When a truck is dispatched, a conveyance report is transmitted to an agent. The truck’s position is tracked via GPS events. When the truck is 20 minutes from the border, there must be a confirmation that customs has received the documents. If that hasn’t occurred, an alert is sent to the agent and the problem is remedied before it can cause a costly problem, incurring fines and wasting man hours.
CEP Model 3: Query-oriented

- Event Bus or Source
  - Low-latency reliable message delivery

- Event and Data Model
  - for information modeling

- Temporal Model
  - for determining time-dependent info

- Pattern Detection Model
  - for recognizing patterns, defining actions

- History and Cache

(Streams of Events)

Continuous Query

Results Event

Query
Query-based Patterns for Event Streams

- Continuous queries for detecting patterns across event streams with SQL-type constructs
SQL/OQL-based Continuous Query Languages

- Extensions allow for:
  - Streaming Events
  - Continuous Queries
- Notifications or events when changes occur in resultset
Query Language – Time Window Example

- Retrieve certain tick info from cached trade data over some period

  ```
  select ... from ...
  {policy: maintain last ... }
  where ... group by ...
  ```
Runtime: Distribute for resilience, scalability

Scalable CEP
- Replicated CEP Agents for load-balancing and hot-standby
Distributed Support

- Distribute event processing agents to load-balance across enterprise
- All agents/engines may share/cooperate on the same event store
- Distributed cache etc used for high performance event stores
- Allows exceeding of single process limits
Managed Decisions
- workflow-enabled Decision Management for Business control of CEP Elements

CEP Framework for Multiple Paradigms / EPLs
- Event Processing Element of multiple types
Example: Decision Manager
Decisions managed by end-users need controlled lifecycles
- Control process can be managed by external applications
- Cover also simple event pattern specifications (etc)
Complex Event Processing Platform and Data Grid

CEP Platform
- distributed Event Processing Agents gives scalability in volume + complexity

Shared Low-Latency Data
- distributed event history Data Grid for Low Latency High Volumes information
1. Automated Trading was but 1 CEP use case (+ 4 CEP vendors) – Rest Of World now moving to CEP

2. CEP exploiting / bringing together other s/w development best practices eg MDA

3. CEP – processing of events is “a process” – business process automation

4. EDA vs SOA

5. Advanced software techniques for boundary cases eg pattern discovery via analytics

6. Exploiting faster networking, cache event storage, etc
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Commercial CEP – creating Use Cases

1. Customer, Vendor discuss problem areas
2. Vendor propose solution using CEP technology
3. Customer agrees to solution
4. Development (in-house / vendor / SI)
5. Production success = use case
Commercial CEP Use Cases from TIBCO

Logistics – Track and Trace
Transport – Situation Awareness
Finance – Sense and Respond
Problem: Timeliness of reports for border-crossings

- Report data is event-driven, asynchronous (manifests, load data, forwarded after loads picked up)

- Border crossings required compliance to regulations, leading to delays in crossing / non-compliance fines / missed schedules

- Requirement: means of processing data “just in time” and handling missing information correctly

Wider Problem: handling process exceptions
Goal: models that provide end-to-end visibility of business processes

- System-to-system, manual and semi-automated processes
- Need to track missing events, SLA violations, and then re-sequence activities based on context
- Identify failures, and re-route according to data-driven workflow rules
Monitoring Processes and Systems: CEP as BAM

**TIBCO General Interface – BAM UI**
- Monitoring
- Actions

**BusinessWorks – Service layer**
- Task & Alert Mgt
- Real-time KPI dashboard
- KPI Analyzer
- Gateways to BI apps

**Integration services layer**
- Allows exposure of KPIs via WebServices

**BusinessEvents – CEP**
- Working Memory
  - KPI, thresholds and alerts
- Cache Server
  - Stores the concepts that are less frequently accessed

**TIBCO Enterprise Message Service**
- Captures and transports events coming from the Information System

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Problem: Personalization of marketing and CRM

- Customer “lifecycle” events drive needs and interest in financial services
- Awareness of customer situation can be implied from data mining, analysis, etc
- Requirement: means of providing customer-relevant communications, assistance, offers etc

Wider Problem: intelligent CRM
Goal: to provide relevant advice to customers during multiple interactions across various + multiple channels

Relevant
- Requires knowledge of customer, current financial status, history of interactions, soft-data (e.g. life events), in real-time or as batch

Advice
- Offers/promotions/campaigns that are targeted at a particular customer (e.g. travel insurance promotion, session w/ financial advisor)

During interactions / across channels
- Whatever the interaction is (service call or request for info)
- Relevant advice must be generated during the customer’s attention span and presented in real-time in the relevant medium

Supporting multiple channels
- Web, phone, ATM, agent, etc.
Customer Interaction Management Example

Channels

Transactions

CEP Rules
CEP Patterns
CEP State Models

Event Channels

Internal Knowledge

External Knowledge

Knowledge

Pluggable Algorithms

New Rules/Patterns
Data Mining
Products
Customers

Events
Responses

Customer Interaction

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TTV 1-800-788-0002

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Integration Architecture & Couplings

1. Mkt defines situation patterns

2. Trigger Events are received

3. Combined with master and historical data

4. Patterns are applied, Offers created/modified

5. Track Customer Communication

6. Users monitor measure, optimize

- Business Users Desktop
- Integration layer
- CEP Business Events
- Transactional Banking Systems
- DW / Customer Accounts / Relationships / Campaigns

Touch point s
- Mail
- Email
- Phone
- Statementing
- Web
- ATM
Marketing defines campaign rules:

IF Customer has large funds-in transaction (> 10 K) AND Customer also uses mortgage calculator on web-site AND both events happen within 1-2 days AND customer profile matches basic eligibility criteria (delinquency, blocked, est. affluence, opt-out) THEN Create “Mortgage offer” for customer in central palette with highest priority available through channels Web, Call-Center, Sms, ATM, Telemarketing
Additional Banking CEP-CRM Uses

- New Mover detected ➔ Personal loan
- Flight ticket purchase ➔ Travel insurance
- Outbound Contact failed ➔ Service offer to supply contact details
- Major credit card transaction ➔ Conversion into loan installment
- Significant Funds-In transaction detected ➔ time deposit offer
- ...

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Problem: Information loads on gate agents

- Multiple sources of real-time information and problems
- Responses to “problem scenarios” (late flight, weather, ...) require full information awareness
- Requirement: means of providing all required event data

Wider problem: Management information in real time and optimizing responses to situations
Airlines Operations - Situational Awareness

- Operational Efficiency and Problem Detection

- Goal: Monitor operational data/events and communicate “problem events” to recovery engines and other systems

  - Listen to multiple sources of data (dispatchers, maintenance control, customer service, ATC/weather specialists, etc.).
  
  - Pass data through a series of dynamic rules, and generate action events.
  
  - Sample rules include:
    
    1. Aircraft forecast late coming out of MX (maintenance).
    2. Flight delayed over 30 minutes.
    3. MX Item exceeds its die date.
    4. Flight estimated to arrive during airport curfew.
    5. A flight had an out-gate time 30 minutes ago: no OffGround message has been received.
    6. MX station is over capacity for scheduled work.
    7. Taxi time from gate to takeoff has been greater than 30 minutes.
Sample Architecture

Situational Awareness
(Present Problems so that user can understand the situation at a glance)

Optimization
LP/MIP Models
Aircraft and Crew Solver

Rules and Patterns related to State Change, Validation, Optimization, Situational Awareness

CEP - TIBCO BusinessEvents

Problem Detected
Solutions
Set of Solutions

Operational Events: Aircraft State, Passenger State, Weather, Airport, ATC...

Operational Data: Aircraft, Crews, Passenger, Maintenance, Ground, etc.

Notifications
Events

Aggregate Problems By Type
Filter By Severity
String Graphs

Problem Store

TIBCO Messaging

Other Data Sources

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Problem: Management of complex railway network resources

- 32K miles of track, 48K employees, 7.5K locos, 87K wagons
- Network schedules difficult to keep due to 3rd party events, staffing regulations etc, track performance: 1 kph = $MM per month

Requirement: situation awareness
Evolving from an “after the fact” awareness to Real time action.
Each train demands the 5 critical resources over time.

- For a train plan to be effective, all trains must have all resources allocated.
- As the train schedule moves, the resource demand moves.
Dynamic Resource Management Requirements

- Provide a Train Lineup with the dynamic updating of train schedules
- Associate trains on Train Lineup with crews
- Improve train movement projections
- Detect opportunities to improve quality of decisions.
- Assess the quality of the Operating Train Plan
Dynamic Resource Management IT Requirements

- Model and Manage Hundreds of Events, Data Values and Relationships Between Individual Crews, Trains, Terminals, and Network Segments, Points, and other entities
- Model and Manage Hundreds of Rules depending on above relationships and data values
- Enable Dynamic Allocation of hundreds of Resources separated by hundreds of miles of track
How Did CEP Help? Event, Data Models

[Diagram showing relationships between different entities such as Train, Train List, Crew, Train Schedule Segment, Network Point, Crewboard, Network Corridor, and Network Subdivision Segment.]
How Did CEP Help? Schedule Lifecycles and States

State Machine to model and monitor a train’s progress over a route
Specific Certification
Problem: Fulfillment of complex product orders liable to change

- Processes are dynamic
- Events cause process changes
For Each Request
Order Plan Development
Order Plan Execution
Repeating Process Components

Goal Driven BPM
Order Request

4. Order Plan Execution

Orders

3. Order Plan Development

2 types available…
- BPM-centric
- Straight-through

Rules

2. Identify & Start Fulfillment Process

Order Request

1. Store Order Request

3 types…
- Manual
- Template
- Automatic

Orders

4. Order Plan Execution

Order Plan

5. Order Complete

Order Entry
Order Plan Designer

- Uses enhanced GANTT chart notation
- Displays run-time status of plans
- Capable of grouping plan tasks
  - GANTT summary task notation
  - Possible to define dependencies from/to groups
  - Nesting possible to any level
  - Possible to import order plan templates as groups
- Browser based
- Used for Manual Order Plan Development
An example Order Plan

- **Process Component**: This maps to underlying BPM process.
- **Orchestration component**: Agnostic of the underlying process engine.
- **Milestone**: Synchronisation points within process components.
- **Dependency**: Linkage between process components. Information may flow through dependencies.
- **Critical path**: The longest path through a plan. Defines the projected end date/time of the plan.
Goal-Driven Process Components

Start Events
- Plan Selection rules
- Plan Building rules
- Rule-based automated processes

Decision Processing
- Change Events
- Business Processes and Services
- SOA Services
  - workflow flows
  - service flows

Goal-driven Plans
- Dynamic Plans
- Templates
- Manual

Business Process Engine
- workflow flows
iProcess Conductor + Rule-driven Events

Optimised Order Plan

Event Management, Correlation, Aggregation, Inferencing and Analysis
Activity History

Rules, Knowledge, Patterns, Models
Inference Engine

Metadata Repository

TIBCO BusinessEvents Workbench
Semantic Modeler
State Modeler
Collaborative Integration
Contextual Integration
Formula Editor
Rule Editor

TIBCO BusinessEvents

Optimised Order Plan

Normalized Data
Collection
Normalization

Product Definitions
Service Image
Order Content

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Using a Rule, identify and start correct fulfilment process.

Order line status updated as Process Components complete.

Process is ready and adds process components to BPM layer.

Order stored in Order repository.

Alternatives are Manual or Automatic.

BPM engine executes Process Component. Last step is status message.

Consult Order Plan again and issue next start message, until Plan is complete.

Template chosen using selection Rule.

Instantiate selected order plan and adds process components to BPM layer.

Using a Rule, identify and start correct fulfilment process.

Static BPM e.g.

Development)

Fulfilment Process

Alternatives are Manual or Automatic.
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6. Future research topics
1. Event and Data representations
   e.g. RDF, ontologies for CEP

2. Event Pattern Discovery
   e.g. algorithms for detecting new types of pattern

3. Event-based Analytics
   e.g. Event-at-a-time statistics etc

4. New visualizations for event processes
   e.g. 3D representations

5. Merger of decision / BPM technologies
   e.g. BEMN vs BPMN2, constraint solvers vs EP

6. Exploiting novel h/w
   e.g. GPU processing for fast event processing
Research Topics for PhDs: use cases

1. Social Event Processing
e.g. Personal Event Management and awareness

2. Novel Sensors
e.g. Exploiting personal weather stations, cellphones

3. Socially Beneficial Applications
e.g. Bio- and Medical-statistics / CEP in healthcare
Research Topics for PhDs: caveats

1. CEP industry is very dynamic
   => don’t follow industry, lead it

2. Build-on / exploit prior art, COTS technologies
   => vendors encourage academic research

3. Exploit vendor relationships
   => join EPTS, use Glossary, help standards
- TIBCO view has been that CEP is simply a solution to real-time business optimization problems

- Multiple CEP examples outside of investment banking now operational (TIBCO market share >40% per IDC)

- Interest from IBM, Oracle, Microsoft will increase awareness in the benefits of CEP