



# **OPERATIONAL AGILITY**

**COMPOSING AND ORCHESTRATING MISSION CAPABILITY  
PACKAGES THROUGH BUSINESS PROCESS EXECUTION  
LANGUAGE (BPEL)**

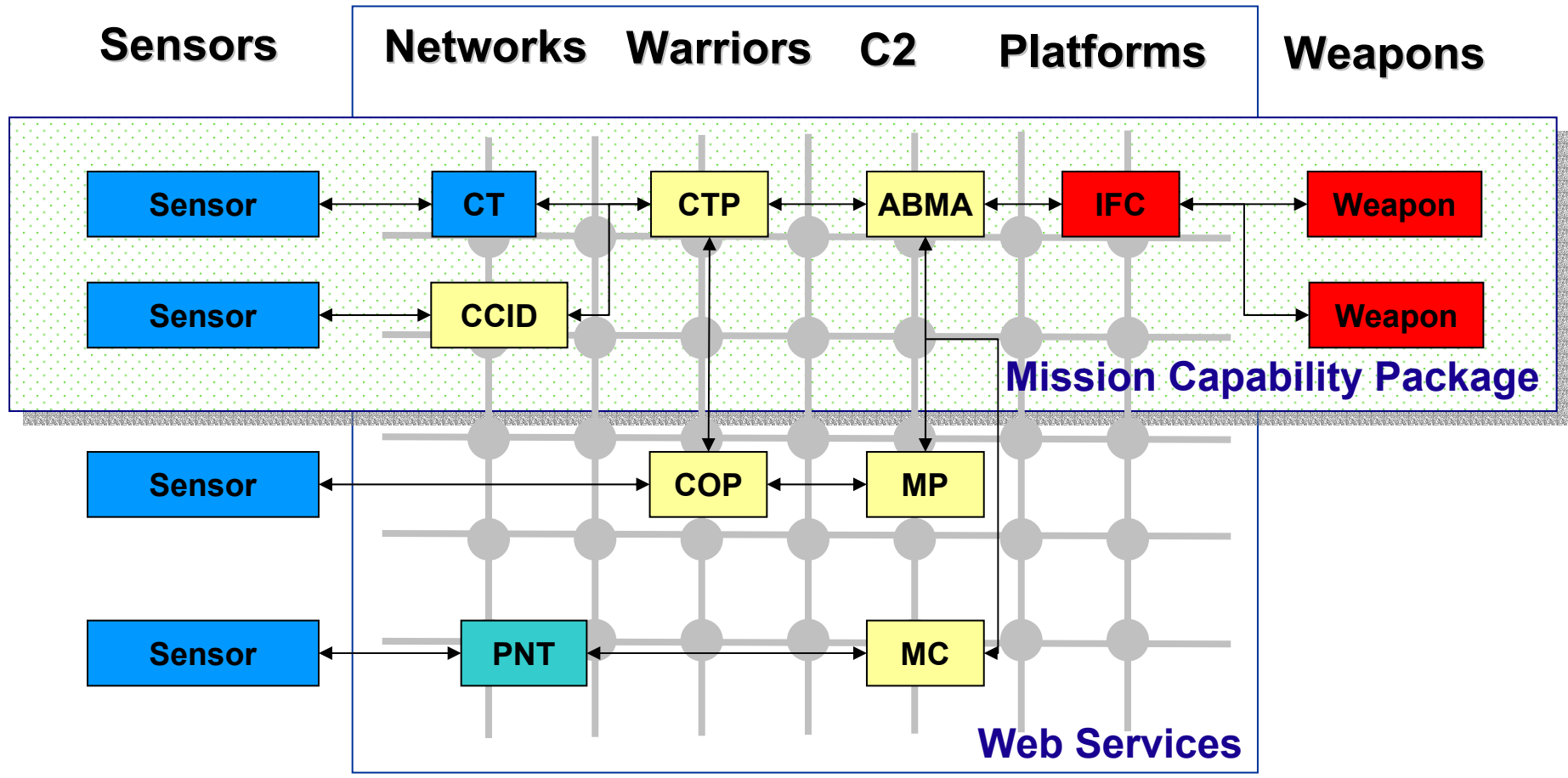
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## Mission Capability Package Defined...

- **Integrate a specific set of joint sensors, platforms, weapons, warriors, networks, command and control systems for the purpose of performing mission-specific engagements.**
- **Ability to dynamically re-configure and re-allocate assets “on the fly” based on current mission needs.**

# Mission Capability Packages



# Technology Vision Applied

PLAN

FIND

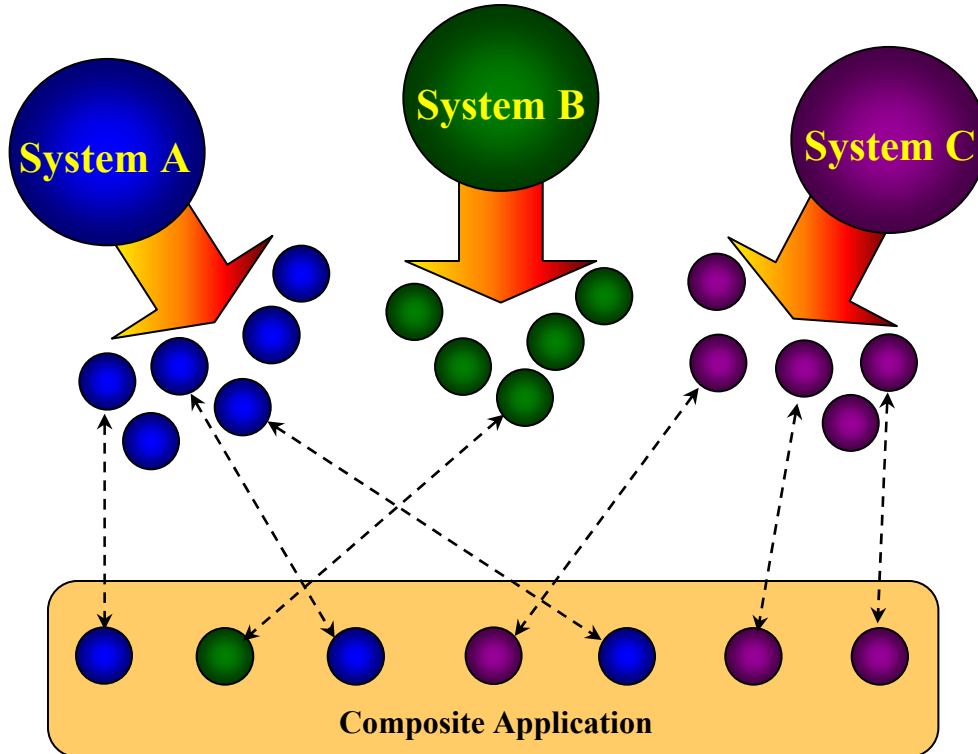
FIX

TRACK

TARGET

ENGAGE

ASSESS



- Deliver components rather than systems
- Components are provided as information services
- Components can be arranged in any way to provide overall composite application
- Component design provides flexibility, higher re-use, and better manageability

# Orchestration

- **Generation of Mission Capability Packages (MCP) from deployed objects and/or services**
- **Composition can take place at design time or run time by Subject Matter Experts**
- **Binding takes place at run time (late binding)**
  - ✓ Bindings can be based on
    - Specific end points
    - Selection of end points that met some specific criteria
- **Dependent on key concepts/capabilities**
  - ✓ Registration/Discovery
  - ✓ Identity Management
  - ✓ Web Services Definition Language
- **Once deployed, newly composed services can be consumed by other services**

# Orchestrating Distributed Services

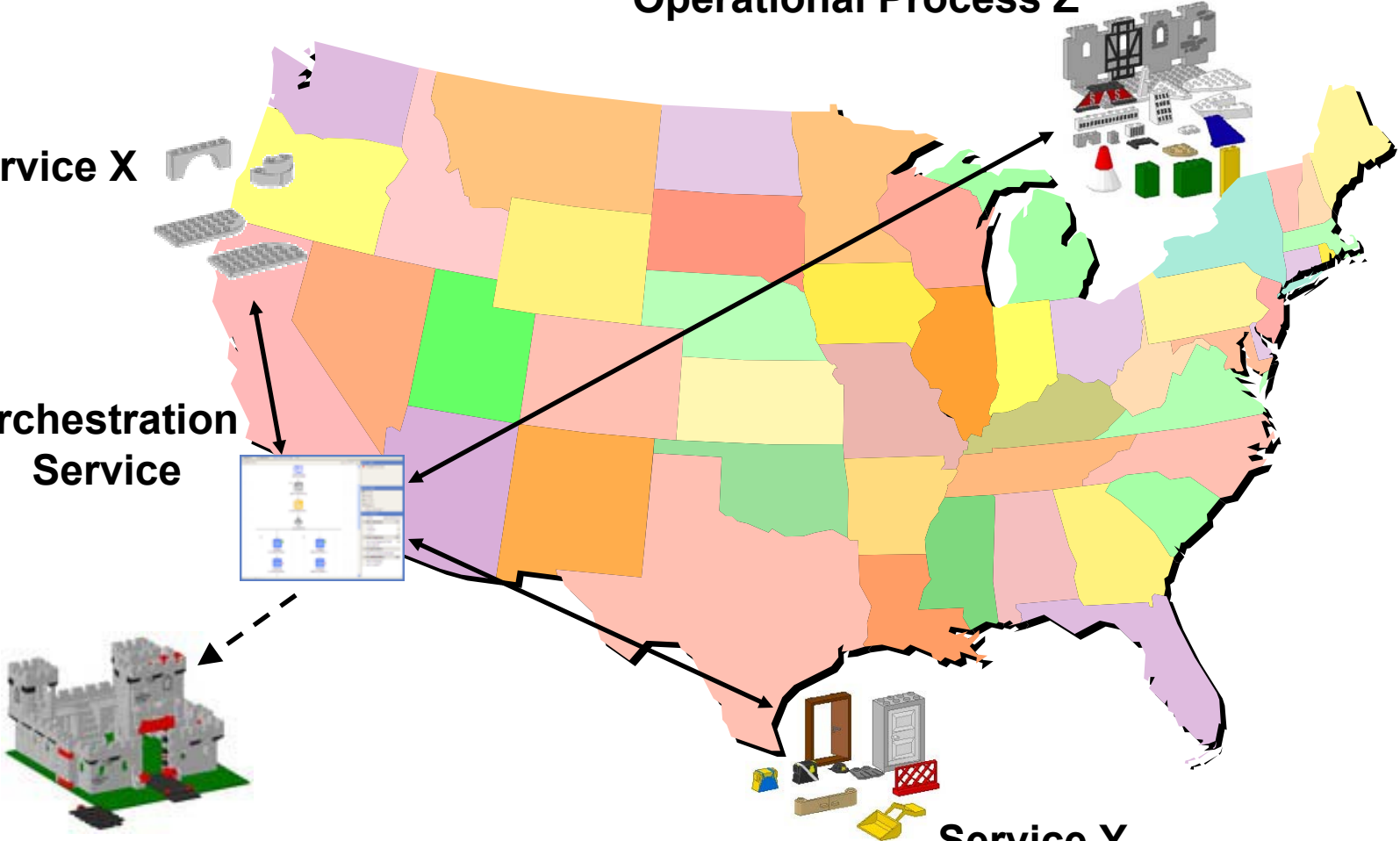
Operational Process Z

Service X

Orchestration Service

Service Y

Mission Capability Package composed and orchestrated from services X, Y, & OP Z



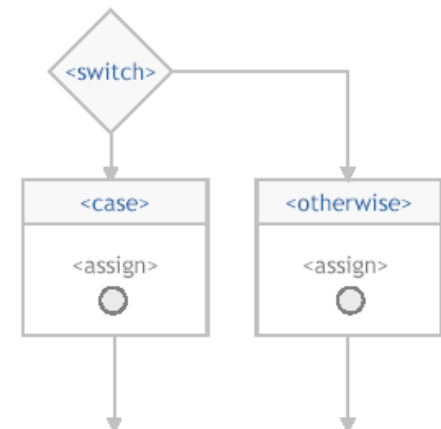
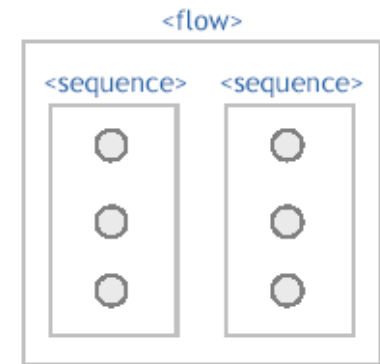
# Orchestration for Web Services

- **Compose Operational Processes, Threads, FnEPs, MCPs, and/or ECMs from Business Process Execution Language (BPEL) for Web Services (BPEL4WS) based on standards work from**
  - ✓ IBM's Web Services Flow Language (WSFL)
  - ✓ Microsoft's XLANG
- **Specifies how collections of services are jointly used to realize more complex functionality**
  - ✓ Describes the data shared between the services
  - ✓ Transactional states and joint exception handling
  - ✓ Separates the flow (execution) from the services themselves
  - ✓ Partnerships/Organizations
- **Once deployed they can be consumed by other Operational Processes, MCPs, FnEPs, ECMs, and/or services**

***XML based Work flow for Web services....***

# Its just XML...

- **<invoke>** a web service synchronously
- **<assign>** and manipulate XML documents
- **<scope>**, **<faultHandlers>** catch and manage exceptions
- Initiate asynchronous processing in parallel **<flow>** of execution
- **<receive>** asynchronous callbacks from long running services/processors
- **<switch>** on a set of pre-defined constraints





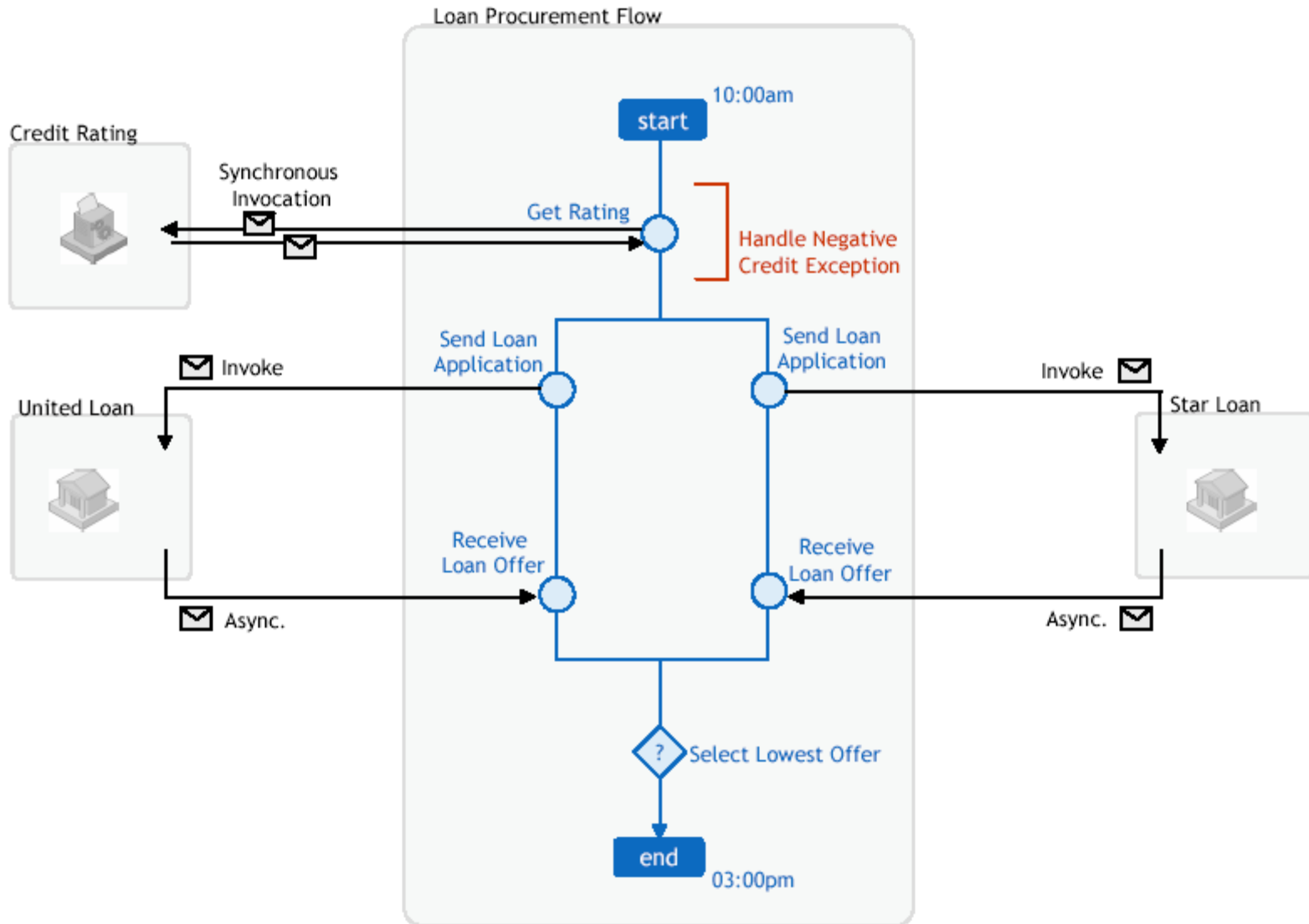
# Example BPEL

```

<!-- ~~~~~
ORCHESTRATION LOGIC: Set of activities coordinating the flow of
messages across the services integrated within this business process
~~~~~ -->
<sequence name="main">
  <!-- Receive input from requestor.
       Note: This maps to operation defined in HpacClient.wsdl
  -->
  <receive name="receiveInput" partnerLink="client" portType="tns:HpacClient" operation="initiate" variable="input"
         createInstance="yes"/>
  <!-- Asynchronous callback to the requestor.
       Note: the callback location and correlation id is transparently handled
       using WS-addressing.
  -->
  <assign><copy>
    <from variable="input" part="parameters" query="/HpacClientRequest/lat">
      </from>
    <to variable="hpacRequest" part="lat"/>
  </copy>
  <copy>
    <from variable="input" part="parameters" query="/HpacClientRequest/lon">
      </from>
    <to variable="hpacRequest" part="lng"/>
  </copy>
  </assign><invoke partnerLink="hpacWS" portType="WSClient:WSClient" operation="getCasualtyInfo" inputVariable="hpacRequest"
         outputVariable="hpacResponse"/><invoke partnerLink="hpacWS" portType="WSClient:WSClient" operation="getShapeFile"
         inputVariable="shapeRequest" outputVariable="shapeResponse"/><assign><copy>
    <from variable="shapeResponse" part="getShapeFileReturn">
      </from>
    <to variable="output" part="parameters" query="/HpacClientResult/result"/>
  </copy>
  </assign><invoke name="callbackClient" partnerLink="client" portType="tns:HpacClientCallback" operation="onResult"
         inputVariable="output"/>
</sequence>
</process>

```

# A BPEL Process Flow



# Time Critical Targeting Orchestration

From TBMCS (via SPF)

Name	Category Code	Status	Latitude	Longitude
USNS MERCY T-AM 19	LEVEL 3	SURFACE	30.1290	49.2550
ADURBAHAW HOSPITAL	LEVEL 4	HTF	29.52	47.6230
DISC CS BN MEDICAL CO	LEVEL 2		30.3850	50.61
NIMITZ CVN 68	LEVEL 2		29.6290	50.15
5725 CS BN MEDICAL CO	LEVEL 2		29.640	43.3950
0026 HO HND MED RVAC BN	LEVEL 2		29.640	49.48
0042 HO HND MEDICAL GRP	LEVEL 2		29.640	49.48
USNS FLEETSURV 9	LEVEL 2		29.670	50.0370
FLEET HOSPITAL UNIT 07	LEVEL 3	MOBILE	29.6430	46.5300
FLEET HOSPITAL UNIT	LEVEL 3	HTF	30.4820	43.1990
20 MEDICAL BN	LEVEL 2		29.2210	78.2210
1ST BN 4TH MAR 2D MARDOV	LEVEL 1	UNK	29.4510	50.6260
USNS ITN BR CO A FUSLE BCT	LEVEL 1		30.0450	49.5070
USNS KITTY HAWK CV 43	LEVEL 2	SURFACE	30.182	49.901

ATO/ACO

From JIPTL and JTL

Name	Category Code	Status	Latitude	Longitude
USNS MERCY T-AM 19	LEVEL 3	SURFACE	30.1290	49.2550
ADURBAHAW HOSPITAL	LEVEL 4	HTF	29.52	47.6230
DISC CS BN MEDICAL CO	LEVEL 2		30.3850	50.61
NIMITZ CVN 68	LEVEL 2		29.6290	50.15
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USNS ITN BR CO A FUSLE BCT	LEVEL 1		30.0450	49.5070
USNS KITTY HAWK CV 43	LEVEL 2	SURFACE	30.182	49.901

Prioritized Target Lists

Orchestration

From JMEMS/WASP/JAWS

Name	Category Code	Status	Latitude	Longitude
USNS MERCY T-AM 19	LEVEL 3	SURFACE	30.1290	49.2550
ADURBAHAW HOSPITAL	LEVEL 4	HTF	29.52	47.6230
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USNS ITN BR CO A FUSLE BCT	LEVEL 1		30.0450	49.5070
USNS KITTY HAWK CV 43	LEVEL 2	SURFACE	30.182	49.901

Target/Weapon Pairing



To ABM

MTF ID	Equipment Name	Event ID
N21636	PATIENT LITTERS	80
N21636	10-BED ATH PACKAGES	80
N21636	25-BED ATH PACKAGES	80
N21636	PATIENT LITTERS	80
N21636	MEDICAL EQUIPMENT SETS	80
N21636	CHEMOPROTECTANTS TABLETS	80
N21636	DOH/VICLINE PAPER	80
N21636	CONTAMINATION	80
N21636	MBC DECONTAM	80
WALCO	MBC AGENT DETECTION PAPER	80
WALCO	PATIENT LITTERS	80
WALCO	10-BED ATH PACKAGES	80

Notional TADIL J messages generated for updated Target Information

From WebCOP

Name	UIC	Rank	Branch	SSN	Vaccinations
REBECCA BASSETT	WDH0A	USA	456461149	POLO	ANTHRAX
JERRY GUARIGOLE		USA	51321760	UNK	ANTHRAX
CHARLES JAVRISOR	A24660	USA	45632420	ANTHRAX	ANTHRAX, SMALLPOX
SHARON MERRICE	A24660	USA	45632445	ANTHRAX	ANTHRAX
MICHAEL SE	A24660	USA	45632989	ANTHRAX	ANTHRAX
GEORGE COON	A24660	USA	45632900	ANTHRAX	ANTHRAX
MICHAEL CAID	A24660	USA	45632944	ANTHRAX	ANTHRAX, MEASLES
RUSSELL THOM	A24660	USA	45632493	ANTHRAX	ANTHRAX
ALICE CADGAMES	A24660	USA	45632983	ANTHRAX	ANTHRAX
DALE KENN	A24660	USA	45632624	ANTHRAX	ANTHRAX
PAULA CERRRAN	A24660	USA	45632791	ANTHRAX	ANTHRAX
LINDA CARR	A24660	USA	45632958	ANTHRAX	ANTHRAX
JEFFREY FAUM	A24660	USA	45632418	ANTHRAX	ANTHRAX
CRISTY KEIR	A24660	USA	45632421	ANTHRAX	ANTHRAX
JERRY KEDGELY	A24660	USA	45632618	ANTHRAX	ANTHRAX
SHARON CROGAN	A24660	USA	45632792	ANTHRAX	ANTHRAX

TCT

From SPF

Name	Category Code	Status	Latitude	Longitude
USNS MERCY T-AM 19	LEVEL 3	SURFACE	30.1290	49.2550
ADURBAHAW HOSPITAL	LEVEL 4	HTF	29.52	47.6230
DISC CS BN MEDICAL CO	LEVEL 2		30.3850	50.61
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Missions & Routes (CRDs)

# Building Operational Processes

**Start asynchronous processing branch**  
 Each branch invokes web services and processes their data independently. Results are later joined for further processing or to be returned

**Avail BPEL Actions**

- Assign
- Invoke
- Receive
- Reply

**Available Web Services**  
 (via UDDI Discovery)  
 Drag and drop web services to the editor pane (center) to Build the BPEL's process flow

**Action Properties**

- URL
- Input Variables
- Output Variables

**BPEL Palette**

- assign
- invoke
- receive
- reply
- More ▾

**BPEL Inspector**

<invoke>	
name	
partnerLink	HpacWe
portType	hpac:Hpac
operation	initiate
inputVariable	mortalit
outputVariable	

# TCT BPEL (Design Time)

**BPEL - FnepTctService.bpel - Collaxa BPEL Designer**

File Edit Navigate Search Project Run BPEL Window Help

Zoom: 100%

**Navigator**

- FnepSpService
  - FnepTctService
    - jsp
    - services
    - .project
    - bpel.xml
    - build.xml
    - FnepTctService.bpel
    - FnepTctService.wsdl
    - SpfDataRequest
    - SpfService

**Overview** | **Process Map** | Upper Element

**Process Map:**

```

    graph TD
      Start(( )) --> Receive[receive]
      Receive --> Init[initiate (client)]
      Init --> Scope[scope]
      Scope --> Fork(( ))
      Fork --> Assign1[assign]
      Assign1 --> Invoke1[invoke]
      Invoke1 --> Assign2[assign]
      Assign2 --> Invoke2[invoke]
      Invoke2 --> Fork2(( ))
      Fork2 --> Assign3[assign]
      Assign3 --> Invoke3[invoke]
      Invoke3 --> Fork3(( ))
      Fork3 --> Assign4[assign]
      Assign4 --> Invoke4[invoke]
      Invoke4 --> Join(( ))
      Join --> End(( ))
  
```

**BPEL Palette**

- assign
- invoke
- reply
- receive
- More Activities ▾

**BPEL Inspector**

```

<process>
  name FnepTctService
  targetNamespaces http://fnep.saic.c
  queryLanguage
  expressionLanguage
  suppressJoinIn
  enableInstance
  abstractProcess
  Partner Links
  client
  spfWS
  alertWS
  XML Variables
  input
  SessionKey
  FolderKey
  Domain
  output
  missionRequest
  missionResponse
  routeRequest
  routeResponse
  acoRequest
  acoResponse
  missionData
  crdData
  acoData
  temp
  msnPublishRequest
  msnPublishResponse
  crdPublishRequest
  crdPublishResponse
  
```

BP Designer | BP Source

Problems Console

event://BrowserReadyEvent?undefined

# TCT BPEL (Execution Time)

Collaxa BPEL Console v2.0 - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://dakine:9700/BPELConsole/displayInstance.jsp?referenceId=bpel://localhost/default/FnepTctService~1.0/1101&mode=flow> Go Links

Collaxa BPEL Console Manage BPEL Domain | Logout | Support

Dashboard BPEL Processes Instances Activities

Title: Instance #1101 of FnepTctService  
 Reference Id: bpel://localhost/default/FnepTctService~1.0/1101  
 BPEL Process: [FnepTctService \(v. 1.0\)](#)  
 Last Modified: 2004-05-06 12:06:20.546  
 State: closed.completed  
 Priority: 0

Visual representation of the history of this BPEL business flow [As of 5/6/04 2:14 PM] [Refresh View](#)

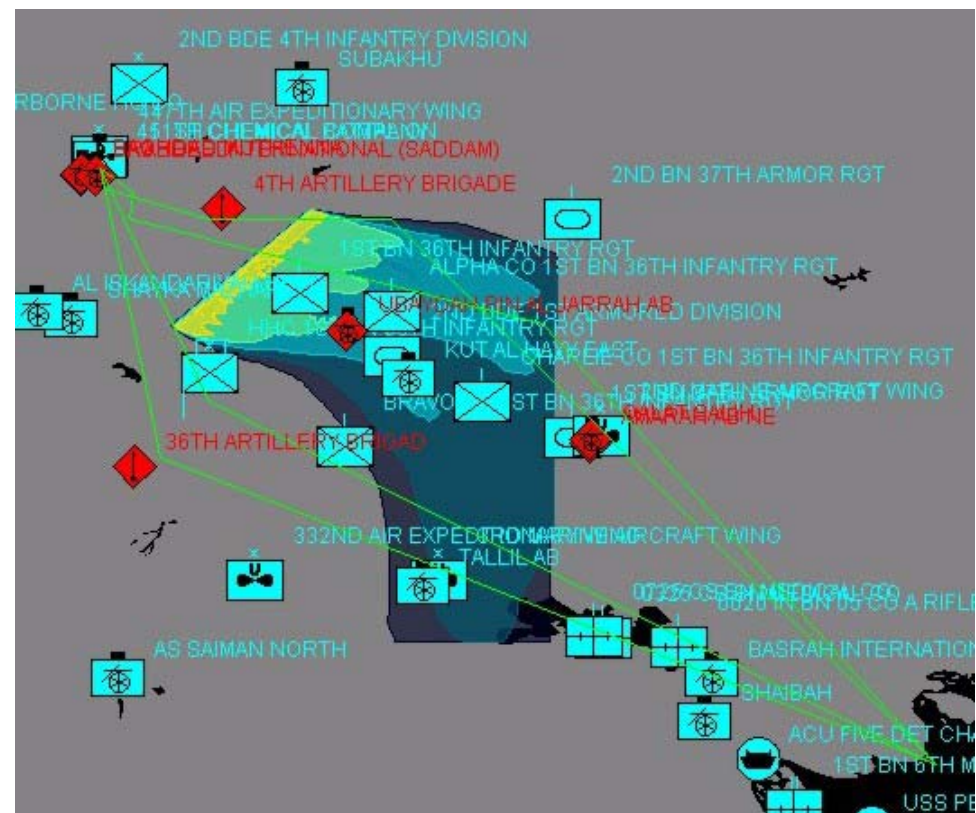
```

graph TD
    Start(( )) --- A1[assign]
    A1 --- I1[spfWS (getData)]
    I1 --- A2[acoPublish]
    A2 --- I2[alertWS (publish_to_t...)]
    
    A1 --- A3[assign]
    A3 --- I3[spfWS (getData)]
    I3 --- A4[crdPublish]
    A4 --- I4[alertWS (publish_to_t...)]
    
    A1 --- A5[assign]
    A5 --- I5[spfWS (getData)]
    I5 --- A6[missionPublish]
    A6 --- I6[alertWS (publish_to_t...)]
    
    I2 --- J(( ))
    I4 --- J
    I6 --- J
    
    J --- I7[client (onResult)]
  
```

Logged to domain: **default** Collaxa BPEL Console v2.0 rc7

Done. 91 entries rendered. Local intranet

# TCT Filtering using BPEL



- Time
- Time On Target
- Weapon/Target Pairing
- Mission Type
- Proximity

# Web-Based JTF Staff Brief Builder

## Brief Management Tool:

**Available Briefs:**

- ▶ BRIEF 1 0071200DEC03
- ▶ **BRIEF 2 151200DEC03**
- ▶ BRIEF 3 261200JAN04

Create New Brief

**Selected Brief:**

BRIEF 2 151200DEC03

Status	Brief Section	Code
✔	Complete Cover	J3
✔	Complete Weather (Joint Area of Operations)	
❌	----- Weather Effects on the Operation	SWO
❌	----- Intelligence SIGACTS	J2
❌	----- Significant Activities (last 24 hours)	J3
✔	Complete SITREPS Received	
✔	Complete JTF Personnel Summary	
✔	Complete Supply Status	
❌	----- Medical Situation Summary	Surgeon
✔	Complete JTF Communications Status	
❌	----- Closing Remarks	J3

= Default text or in Draft   
  = Submitted   
  = Complete  
 = Due in one hour   
  = Past deadline (Late)

File Name	Build Date/Time
BRIEF 2 151200DEC03.ppt	2/16/2004 2:19:56 PM

## Weather Effects on Operations Slide

**Slide Editor - Microsoft Internet Explorer**

**Slide Editor:** Save Close

Brief: BRIEF 2 151200DEC03  
 slide: Weather Effects on the Operation  
 Code: SWO

Status:  Submitted

---

**Current Weather at St Athan Royal Air Force Base:**  
 DTG: 2004-02-16T12:50:00Z  
 WX Station: EGDY - St Athan Royal Air Force Base, United Kingdom @ 51.4°N -3.433°W 500m  
 Visibility: visibility is at 5000m  
 Cloud Cover: null  
 Surface Wind: prevailing wind is 3.087 m/s from WSW (250')  
 Temperature: 9c (76% RH)

**Change Weather Report Station / Update Weather Data:**

Country: UNITED KINGDOM  
 Location: ST ATHAN ROYAL AIR FORCE BASE

---

**Impact of Weather Effects:**

	Visibility	Clouds	Wind	Temp	Overall
Aviation:	None	Moderate	None	None	Moderate
IEW:	None	None	None	None	None
NBC:	None	None	None	None	None
Personnel:	None	None	None	None	None
SOF:	None	None	Moderate	None	Moderate
Threat:	None	None	None	None	None

## Auto Generated Brief

UNCLASSIFIED

**Weather Effects on the Operation**

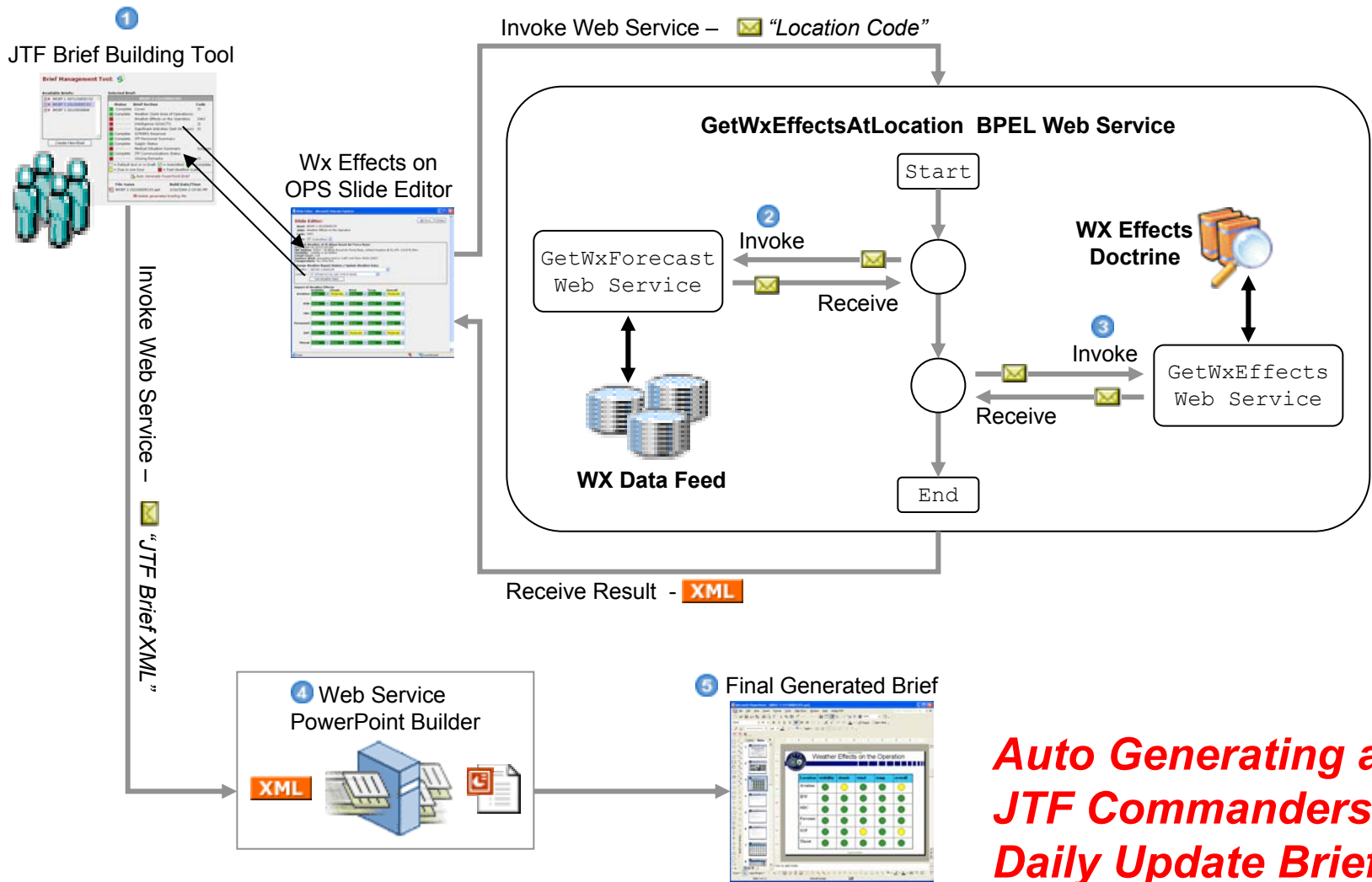
Location	visibility	clouds	wind	temp	overall
Aviation	●	●	●	●	●
IEW	●	●	●	●	●
NBC	●	●	●	●	●
Personnel	●	●	●	●	●
SOF	●	●	●	●	●
Threat	●	●	●	●	●

UNCLASSIFIED

*Invokes Operational Process that gathers data and processes it based on "FM 34-81-1 Weather effect on Operations Field Manual"*

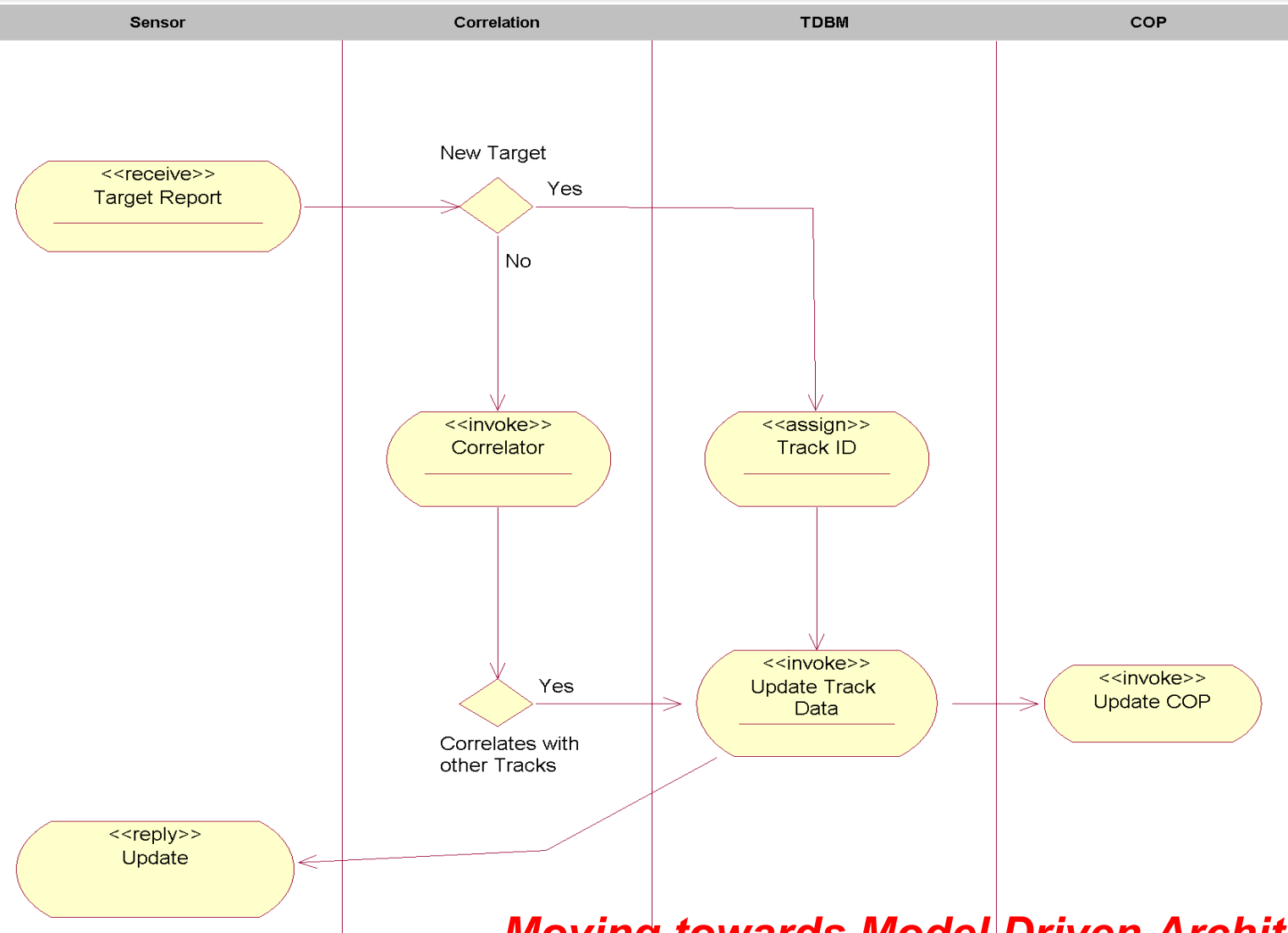


# Operational Process Flow



**Auto Generating a JTF Commanders Daily Update Brief**

# Modeling Operational Processes in UML



***Moving towards Model Driven Architectures***



# Questions

# Acronyms/Terms/Definitions

- **MCP**                      **Mission Capability Package**
- **FnEP**                     **FORCEnet Engagement Pack**
- **ECM**                     **Evaluation Capability Module**
- **BPEL**                    **Business Process Execution Language**
- **BPEL4WS**               **BPEL for Web Services**
- **WSDL**                  **Web Services Definition Language**
- **TCT**                    **Time Critical Targeting**
- **IFC**                     **Integrated Fire Control**
- **ABMA**                  **Automated Battle Management Aid**
- **CT**                      **Composite Tracking**
- **CCID**                   **Composite Combat ID**
- **COP**                   **Common Operational Picture**
- **CTP**                   **Common Tactical Picture**
- **C2**                     **Command & Control**
- **UML**                   **Unified Modeling Language**
- **JTF**                    **Joint Task Force**

