# Agile Schemas for Net-Centric Situational Awareness

**CCRTS 2006**

MITRE

# Part 1

## The Hardware

# AC130 SA Need

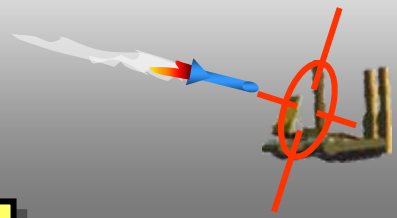
- AC130U/H model has limited situational awareness today
  - Want air picture
  - Support Army and Marine ground forces
  - Need live threat pictures for AOR
  - Are not visible to other aircraft in AOR
- Combined near real-time air picture not available from one source
  - Size, weight and power constraints
  - Mounting new antennas (holes in AC) problematic
  - Costly to procure each system and integrate with aircraft (e.g. Link-16, EPLRS, SINCGARS, etc)

# Machine to Machine Approach Enables SA Feed from Many Systems

AC130U Gunship

ADSI (Link16)

Link-16 (SA Picture)

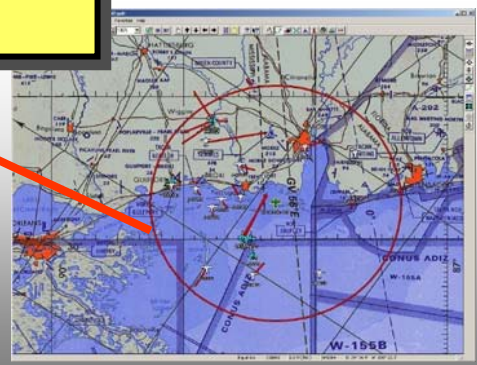


XML-based Machine-to-machine Exchange

FBCB2

GCCS COP

720th STS BAO Kit/ TACP-M



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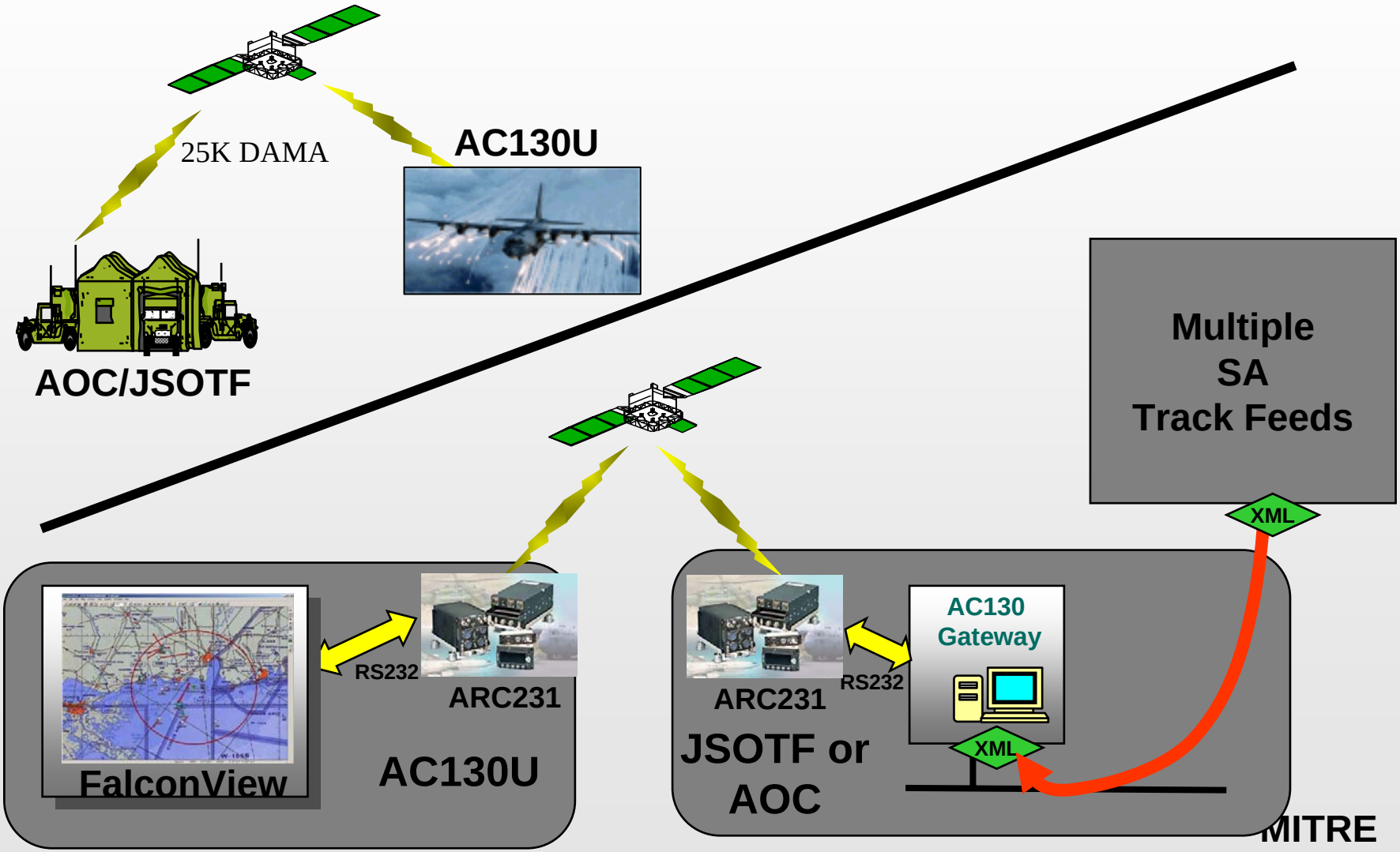
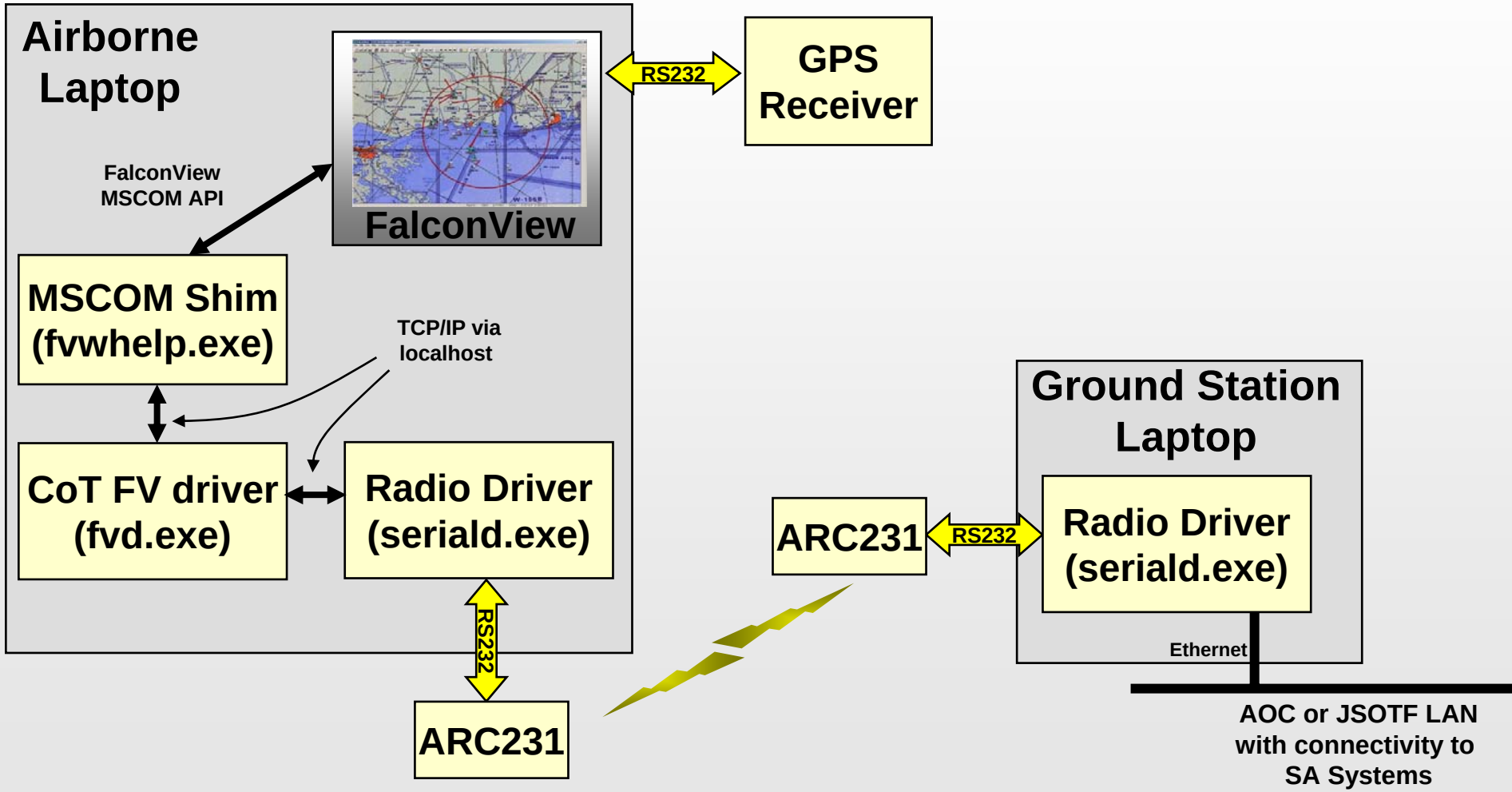
# Connectivity Diagram



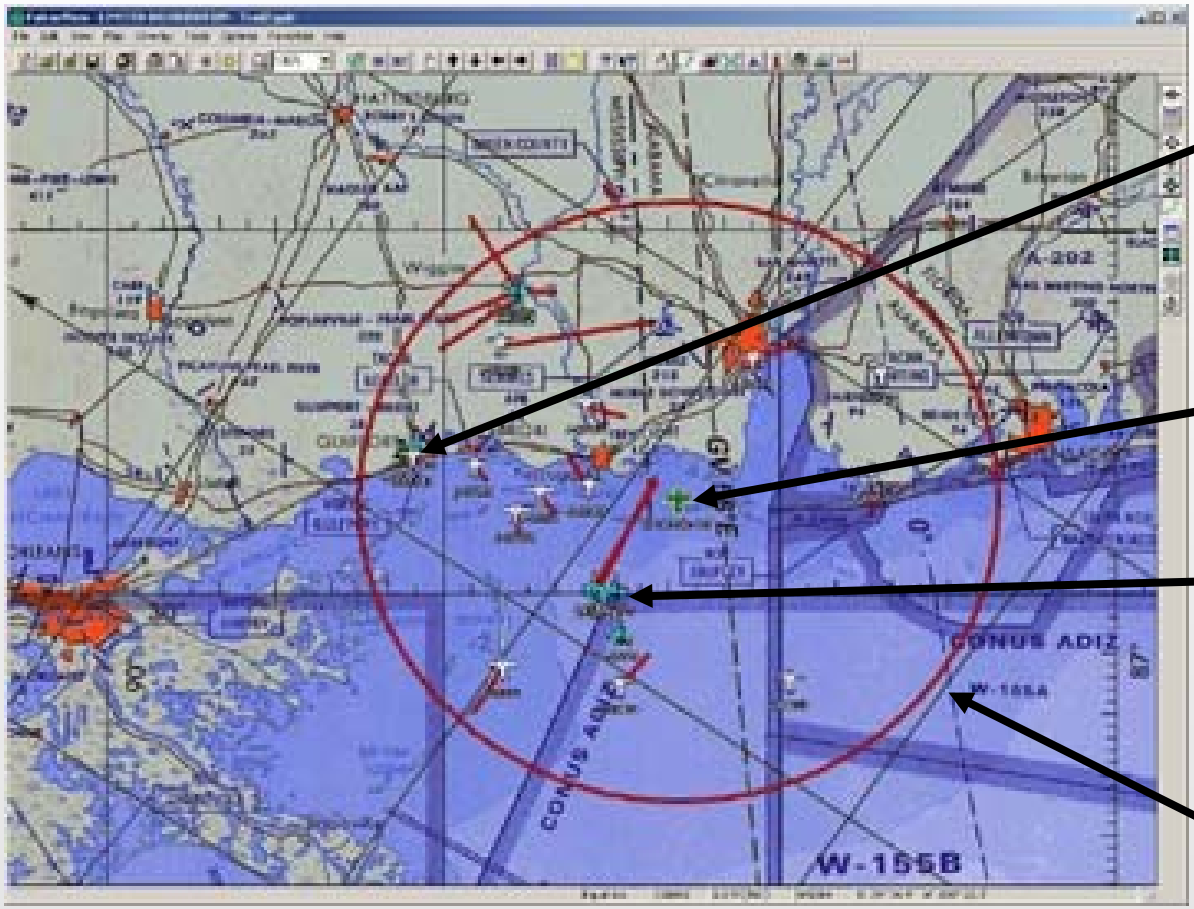
# SA Picture Via Machine To Machine Interfaces

- GCCS (COP)
  - AF/Army/Marines use common Track Database (TDBM)
  - CoT Interface supports pulling track information from each of these data bases.
- FBCB2 (Army)
  - Provides blue force picture for Army ground troops
- Battlefield Air Operations Kit (BAO)
  - 720th STS positions
- Link-16 Via ADSI/CoT Gateway
  - Developed for CoT
- C2PC – Marine Corp. SA system

# CoT Architecture



# Example FalconView SA Display




Ground tracks from GCCS, FBCB2, BAO kit…

AC130 Own position

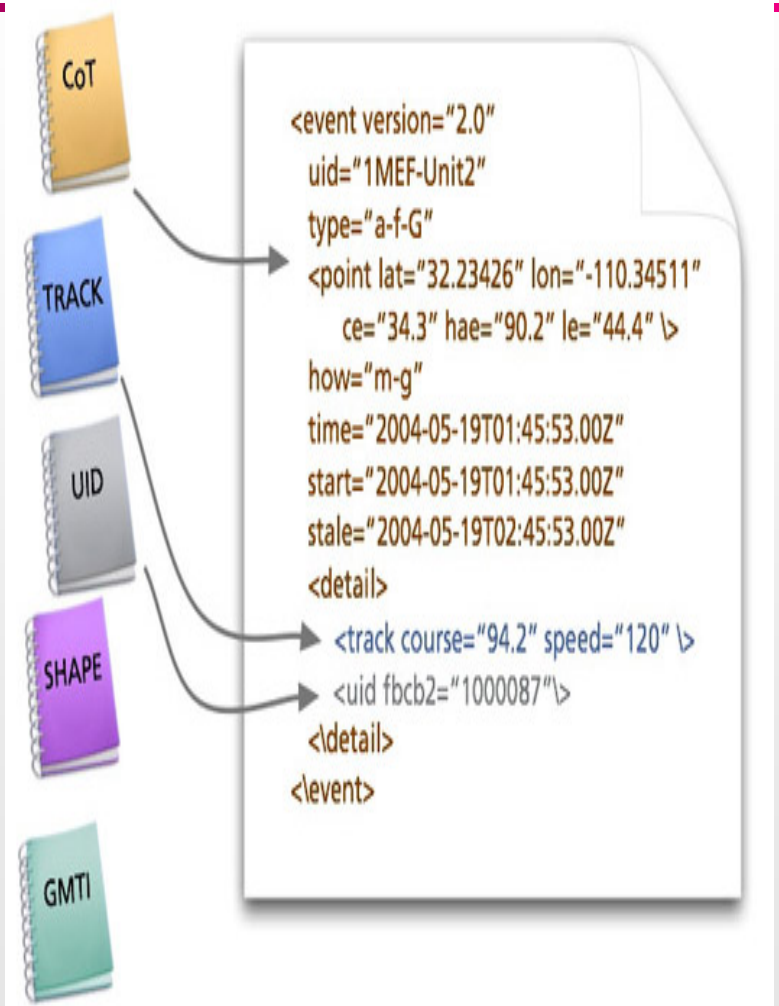
Air tracks from GCCS, Link-16, ...

Geo-filtered based on own position

# Part 2

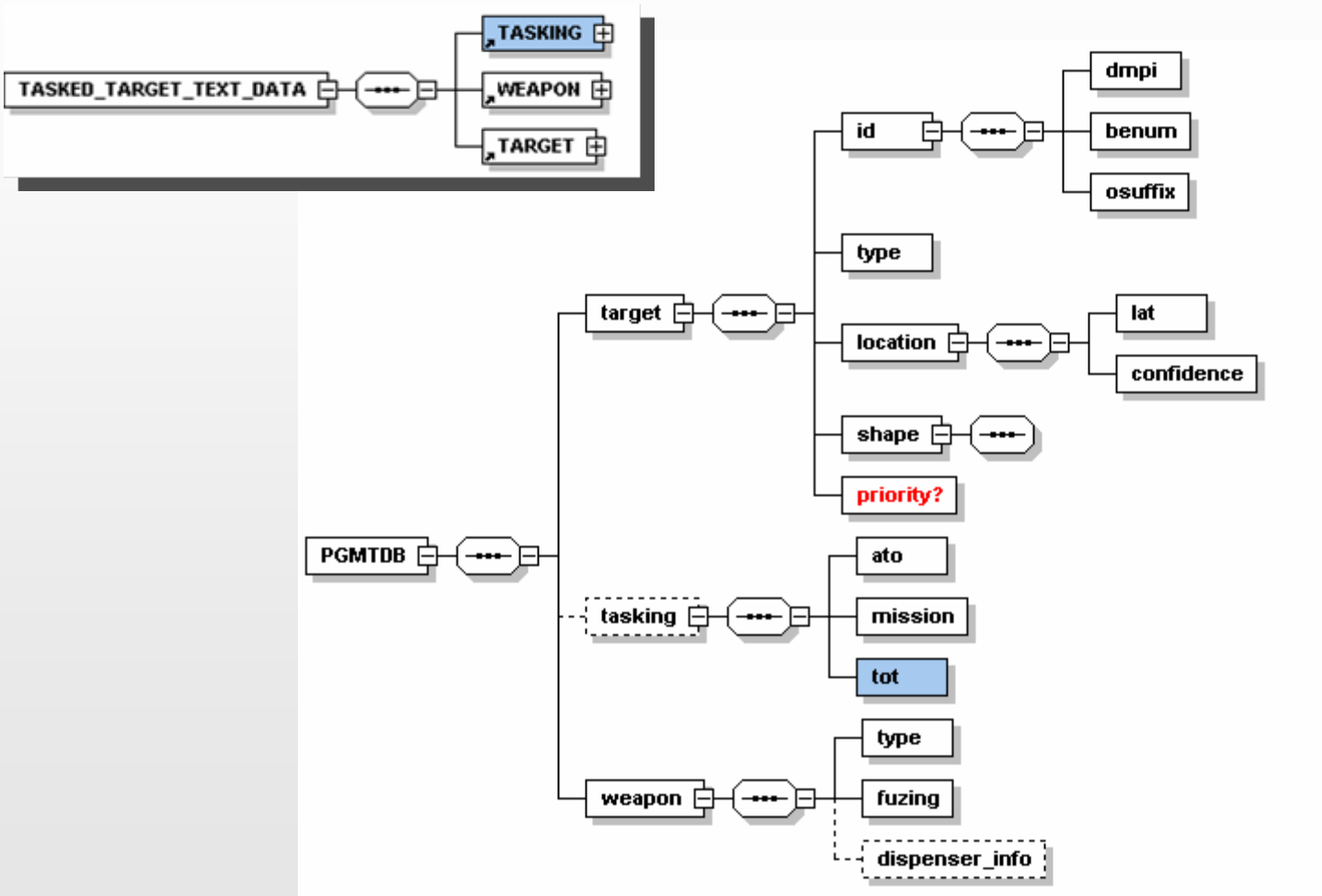
## The Software

# CoT: Main Schema for *generic* WWW information



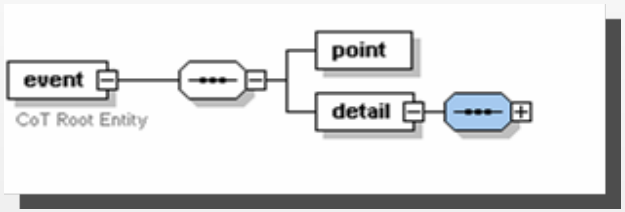

| | | |
|---|---|---|
| **What** | Version | Schema version, stable at 2.0 since about May 2003 |
| | UID | Unique ID much like IP address |
| | Type | What is this event? friendly tank, hostile target? |
| **When** | Time | Time event was generated |
| | Start | Start of "valid" interval for event |
| | Stale | End of "valid" interval for event |
| **Where** | Lat | Latitude based on WGS84 in decimal degrees |
| | Lon | Longitude based on WGS84 in decimal degrees |
| | CE | Circular error about point (Gaussian 1 Sigma) in meters |
| | HAE | Height above ellipsoid based on WGS84 in meters |
| | LE | Linear error about HAE (Gaussian 1 Sigma) in meters |
| | How | Indication of how event was generated (machine, human) |

# PGMTDB: Main Schema for Precision Guided Munitions



# Do the CoT and PGMTDB Schemata Try to Accomplish the Same Function?

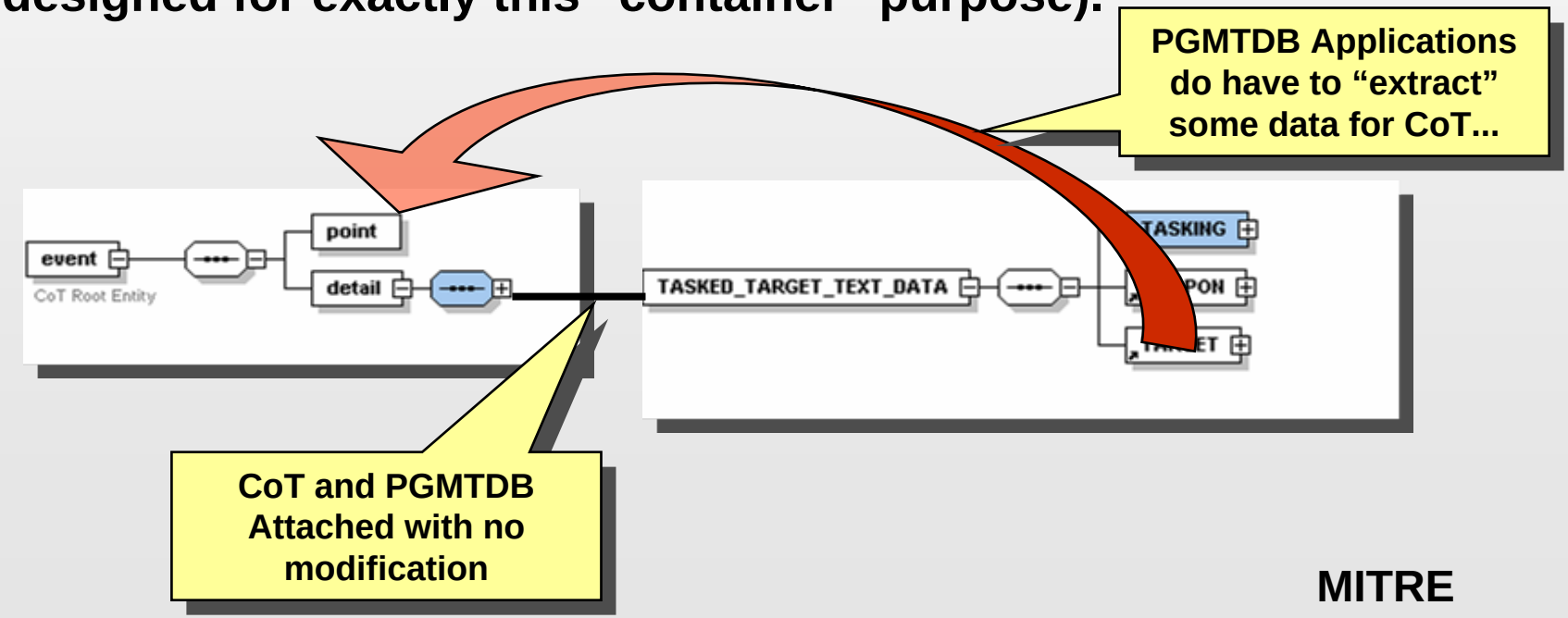
- **CoT schema provides a *simple abstract* of "events" that occur in space and time. Applications don't have be be in any "community of interest" to get key info (what, where, when). CoT defines just *three entities***




- **The PGMTDB schema contains *detail* information of particular interest to the *targeting community*. It defines *59 entities*. Those *outside the community* don't need (and can't handle) that much detail.**

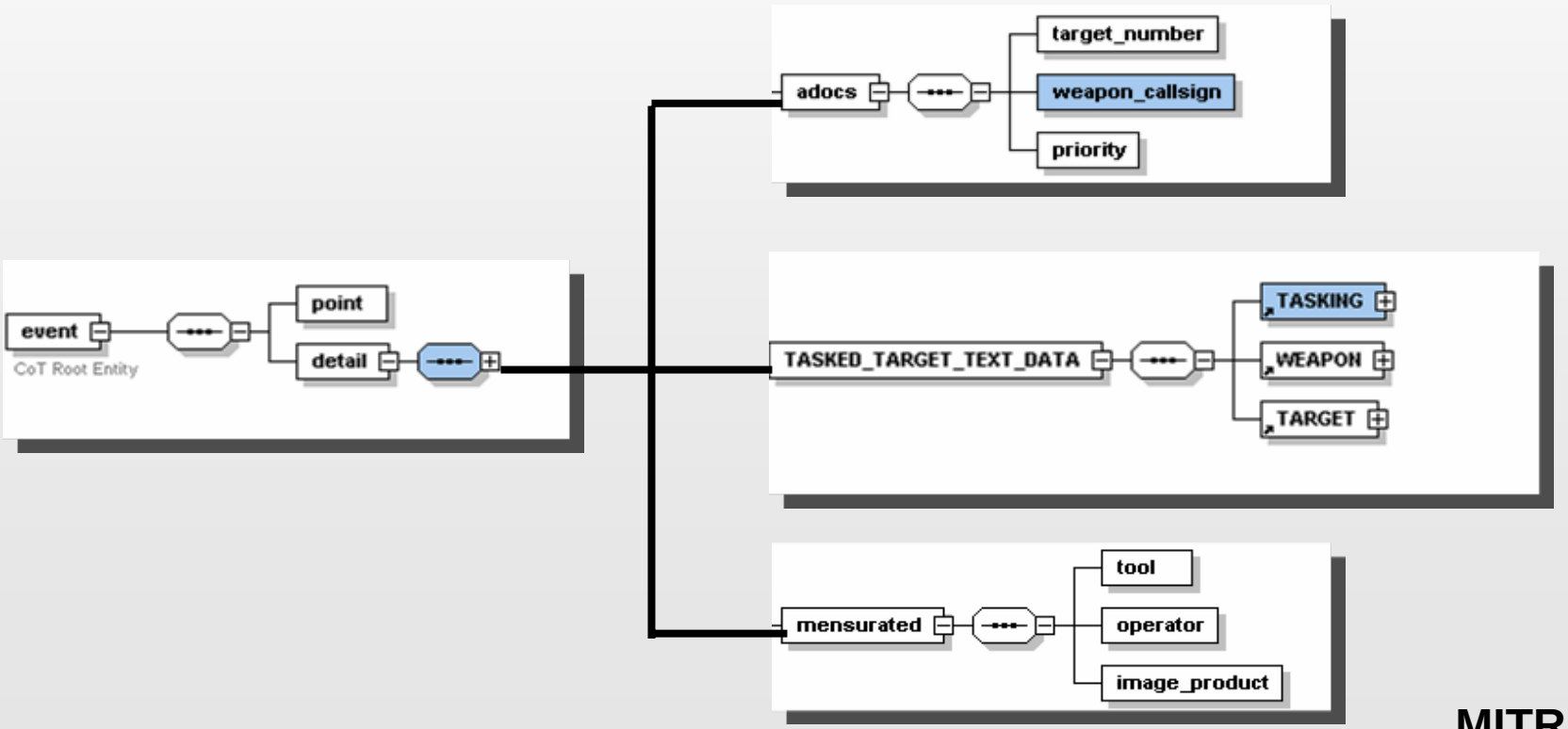
# How Should CoT and PGMTDB Interact?

- Use CoT as “container” for PGMTDB, then non-targeting applications can get the essential “what, where, when” information about pending strikes and targeting apps still get all the details. The “abstract” is crucial for functions like fratricide avoidance, automated BDA tasking, etc, ...
- No modification is required to either schema (CoT was designed for exactly this “container” purpose).



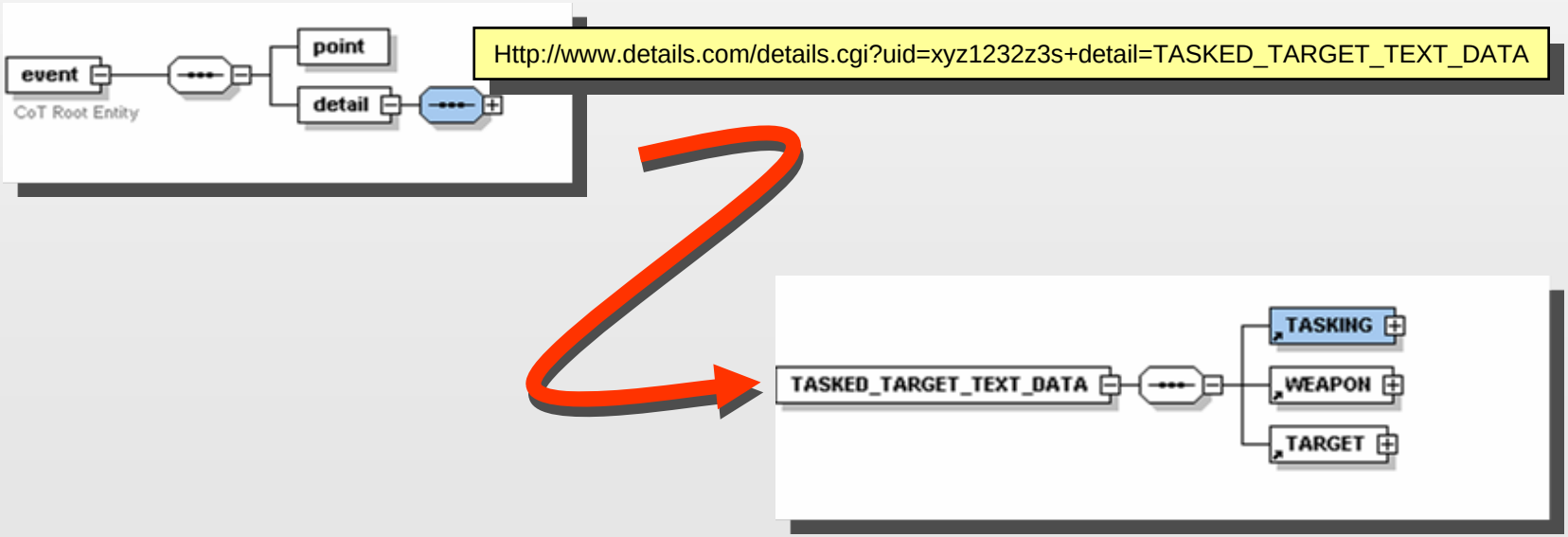
# Why Carry PGMTDB Within CoT? Why Not Just Keep Them Separate?

- Different communities have different “views” of the same event as moves through the kill chain. If the association between these views is not kept, re-association “fusion” is tremendously hard.



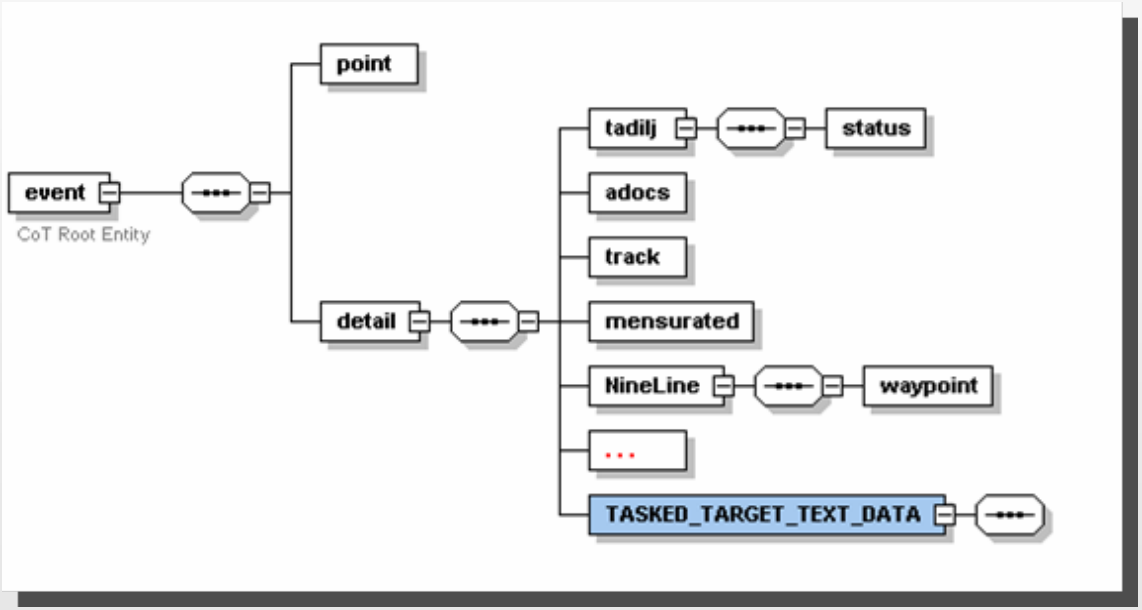
# So I'll Have to Process Megabytes of Other People's Data That I Don't Care About?

- **No.**
  - **The other schemata are "opaque" and can be ignored.**
  - **CoT will provide ways to "detach" the details and pass around only the "abstracts". Details can then be fetched with "query-response" mechanism or by "subscription".**



# Is PGMTDB the Only “Detail” Sub-schema?

- No, there are “detail” schemas for
  - tadilj, adocs, fbcb2, ground and air tracks, mensuration tools, falcon view, digital nine-lines,

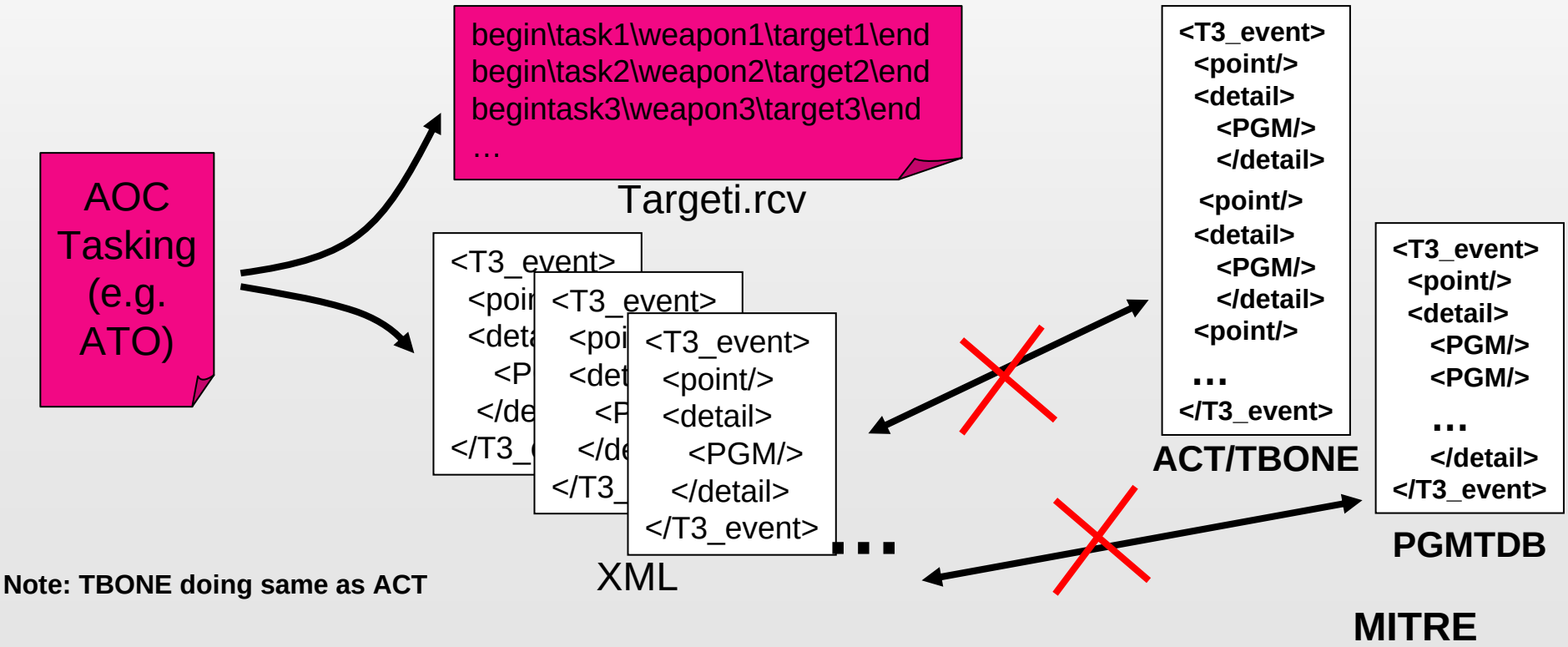


# Part 3

## The Problem: From TCP/IP “Push” models to Net-Centric Web Services “Pull” models

# How to Manage Multiple Targets?

- Target text file can contain multiple targets
- CoT event/PGMTDB event XSD models one target per XML instance
- ACT/TBONE/PGMTDB each attempt to place all ATO targets in single XML document—fails XML validation



# Net-Centric is a “Pull” Model

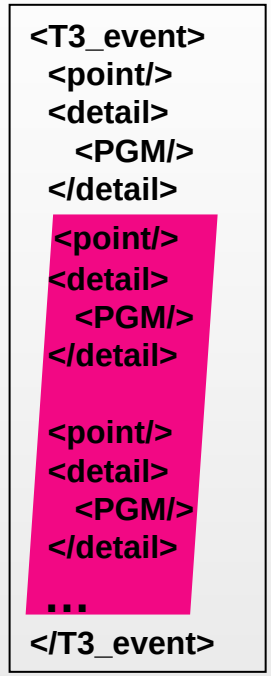
- **TCP/IP “pushes” data: *data is everywhere***
  - **Packets small and frequent: optimized for low-bandwidth hardware (data radios)**
- **Web Services “pull” data: *data is stored at the right location on the network and retrieved just-in-time***
  - **SOAP envelopes large and infrequent: optimized for high-bandwidth wireline systems: Command & Control software frameworks such as JMPS and TBMCS**
- **Does this have any impact on CoT schema?**

# Manage Multiple Targets: Options

1. ACT/TBONE Approach
2. PGMTDB Approach
3. XML Wrapper Approach
4. SOAP/Web Service Approach
5. “CoT for Web Services” Approach

# ACT/TBONE Approach

- **Single <event>**
- **Repeat <point>, <detail>**
- **Pros**
  - **Already implemented in TBONE/ACT**
  - **Retains CoT <point> characterization**
- **Cons**
  - **CoT start/stale time elements limited to ATO periods**
  - **Not generally CoT compatible**

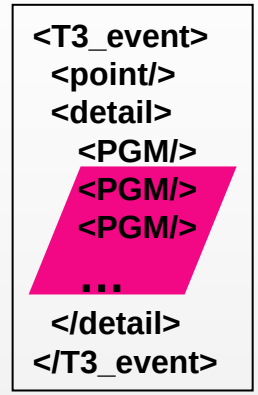





indicates proposed change to XML

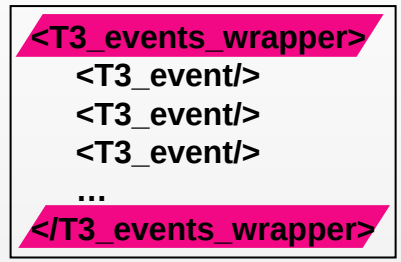
# PGMTDB Approach

- Single <event>, <point>
- Repeat <detail>
- Pros
  - Already implemented in PGMTDB
    - = Delivered for JMPS, MPS, PFPS version
    - = Status:
      - JMPS PGMTDB CC (not fielded)
      - PFPS PGMTDB ISM (fielded)
      - MPS PGMTDB ISM (fielded)
  - Very “targeti.rcv”-like
- Cons
  - CoT start/stale time elements limited to ATO periods
  - Single <point> must be an arbitrary selection of one of all “ATO” points
  - Not CoT compatible



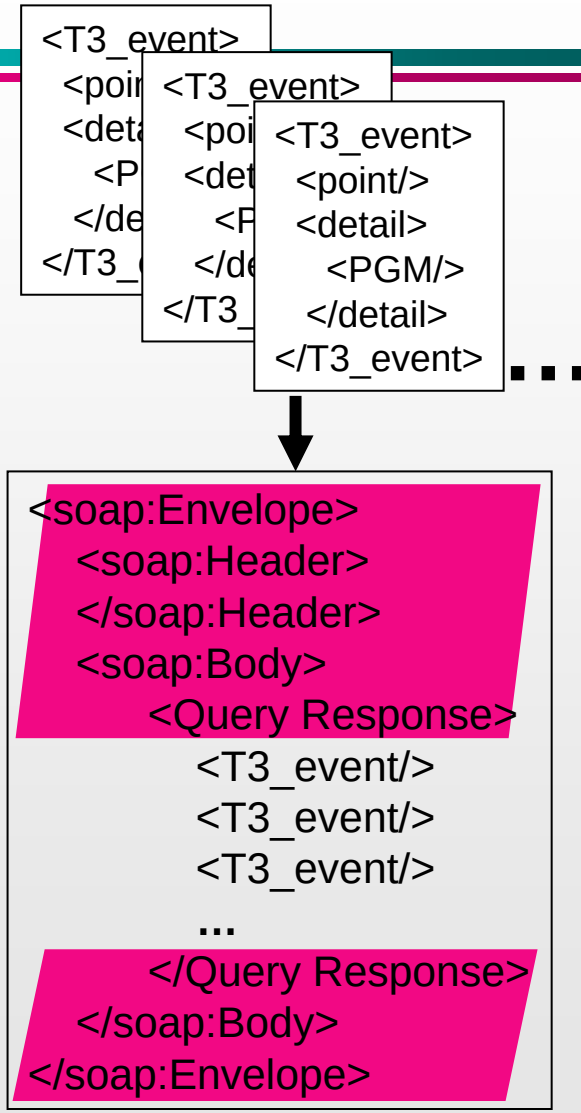
# XML Wrapper Approach

- Add a superset XML element to hold many v1.0 <T3_event> instances
- Pros
  - Conceptually straight forward
  - Retains much of v1.0 schema
  - CoT-like
  - Can also be used in a web service implementation
- Cons
  - Carries forward v1.0 weaknesses
    - Redundant data fields
    - No comparison/update inherit in design



# SOAP/Web Service Approach

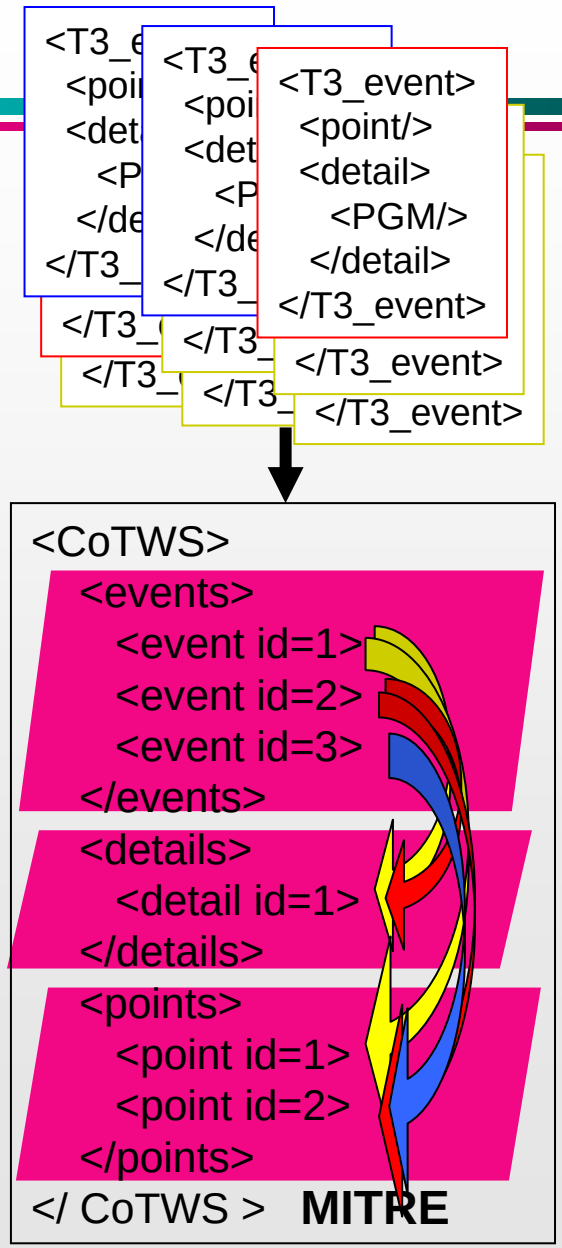
- Single file for each DMPI
- In context of future web services, define SOAP response that packages separate XML files together
- Pros
  - No changes to v1.0 schema
  - Very CoT-like
  - Brings focus on web service, M2M interactions vice flat file (in XML format) exchanges
- Cons
  - Forces management of many small XML files outside of web service context
  - Bound to SOAP implementation




indicates proposed change to XML

# CoT-WS Approach

- "CoT for Web Services" (CoTWS) is a proposal for a flexible enhancement to CoT that suits the Tasked Target Data problem space
- Major restructuring of XML schema to allow IDBTF-like capabilities
  - **Add, delete, update features**
  - **Loose coupling between (event, detail, point)**
- Pros (machine-oriented)
  - **Supports requirements of ACT/TBONE to provide pre-ATO and post-ATO tasking (M2M comparisons between the two)**
  - **Removes redundancies in current v1.0 <detail>**
  - **Similar to IDBTF basis of strati OB files (App B)**
  - **Not bound to any SOAP implementation**
- Cons (not human-oriented)
  - **Complex, not as conceptually straight forward**
  - **More rework by current implementers of v1.0 schema**

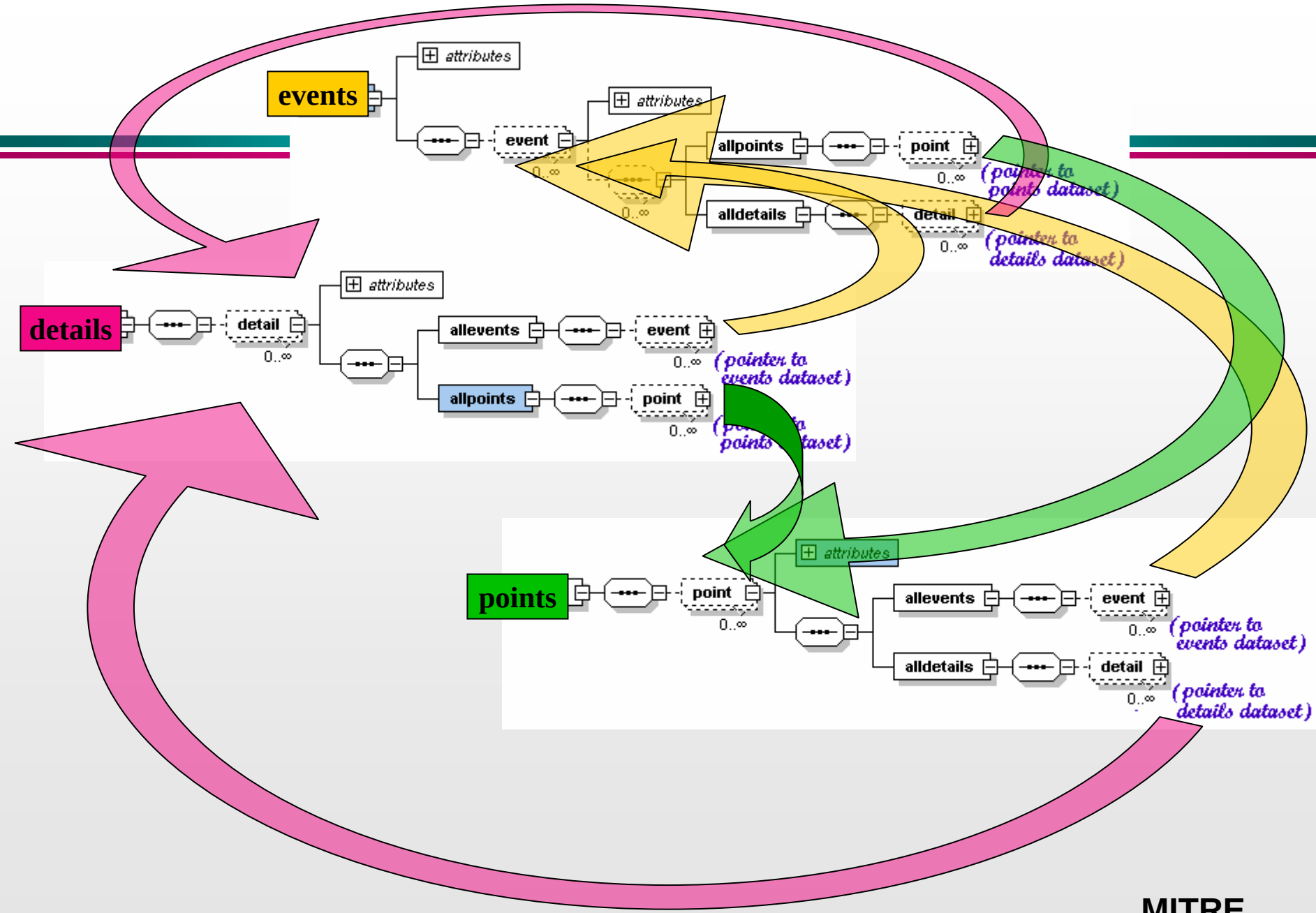



indicates proposed change to XML

# Approach Summarization

| Option | Approach \ Feature | Fielded | v1.0 Reuse | CoT Reuse | Human Readbale/ Less Complex | Implementation Independent | Comparison Features | Addresses Redundancy |
|---|---|---|---|---|---|---|---|---|
| 1 | ACT/TBONE Approach | No | Yes | Yes* | Yes | Yes | No | No |
| 2 | PGMTDB Approach | Yes** | Yes | No | Yes | Yes | No | No |
| 3 | XML Wrapper Approach | No | Yes | Yes | Yes | Yes | No | No |
| 4 | SOAP/Web Service Approach | No | Yes | Yes | Yes | No | No | No |
| 5 | "CoT for Web Services" Approach | No | No | No* | No | Yes | Yes | Yes |

Yes**: By PGMTDB only
Yes*: Can't represent CoT time attributes for each event
No*: CoT WS is a proposed future CoT evolution


events
attributes
event
attributes
allpoints
point
0..∞
(pointer to points dataset)
alldetails
detail
0..∞
(pointer to details dataset)
details
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detail
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allevents
event
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(pointer to events dataset)
alldetails
detail
0..∞
(pointer to details dataset)

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# How does this approach improve SA?

- Events, details, and points are linked
- Users can query for events based on points or details, etc., and “illuminate” relevant information on a SA display (information context preserved)
  - How “complex” is this target (how many events is it linked to)?
  - How many targets are linked to a single event?
  - How many targets have similar details (and thus can be handled by similar munitions)?

# The End

**Thank you**