



Situational Detection is more than just Sensor Detection

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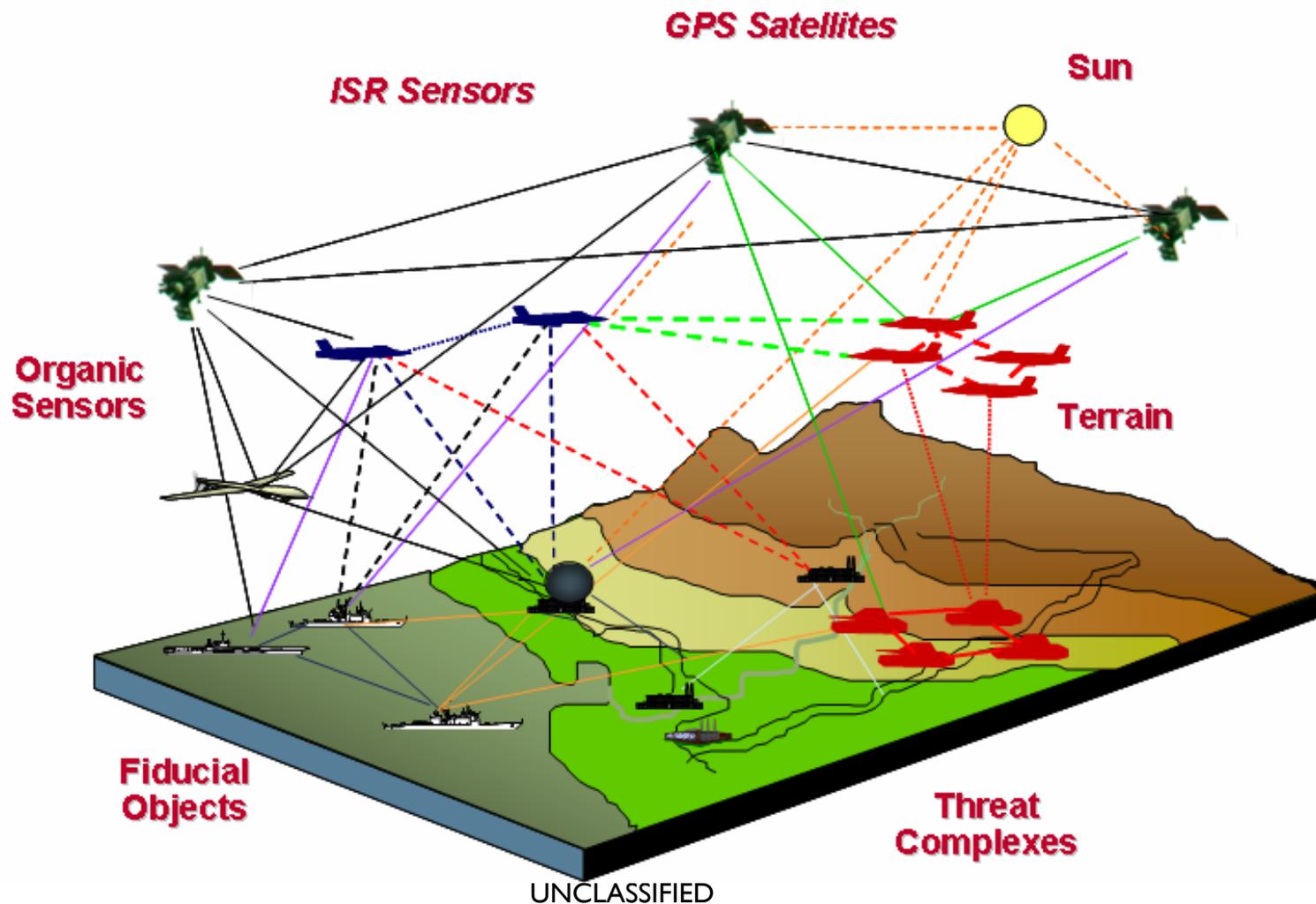
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**National Center for the Study of
Preparedness and Catastrophic
Event Response (PACER)**

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UNCLASSIFIED

The process of associating, correlating and combining data and information from multiple sources to achieve refined assessment of objects, situations and threats.



In Nearly Every Application:

We Are Drowning in **Data**

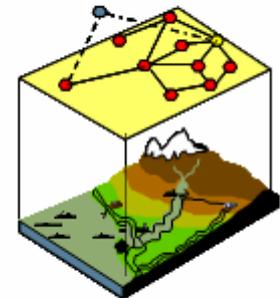
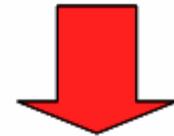
- More Sources
- More Source Types: NTM, Tactical, Commercial
- Wider Bandwidths
- More Connectivity: GCCS, DII/COE

But Starving for **Information**

- How does data relate to the situation (context)?
- What is its significance (impact on my plans)?
- What is its quality? Can I trust it?
- How can it be confirmed, refuted or refined?

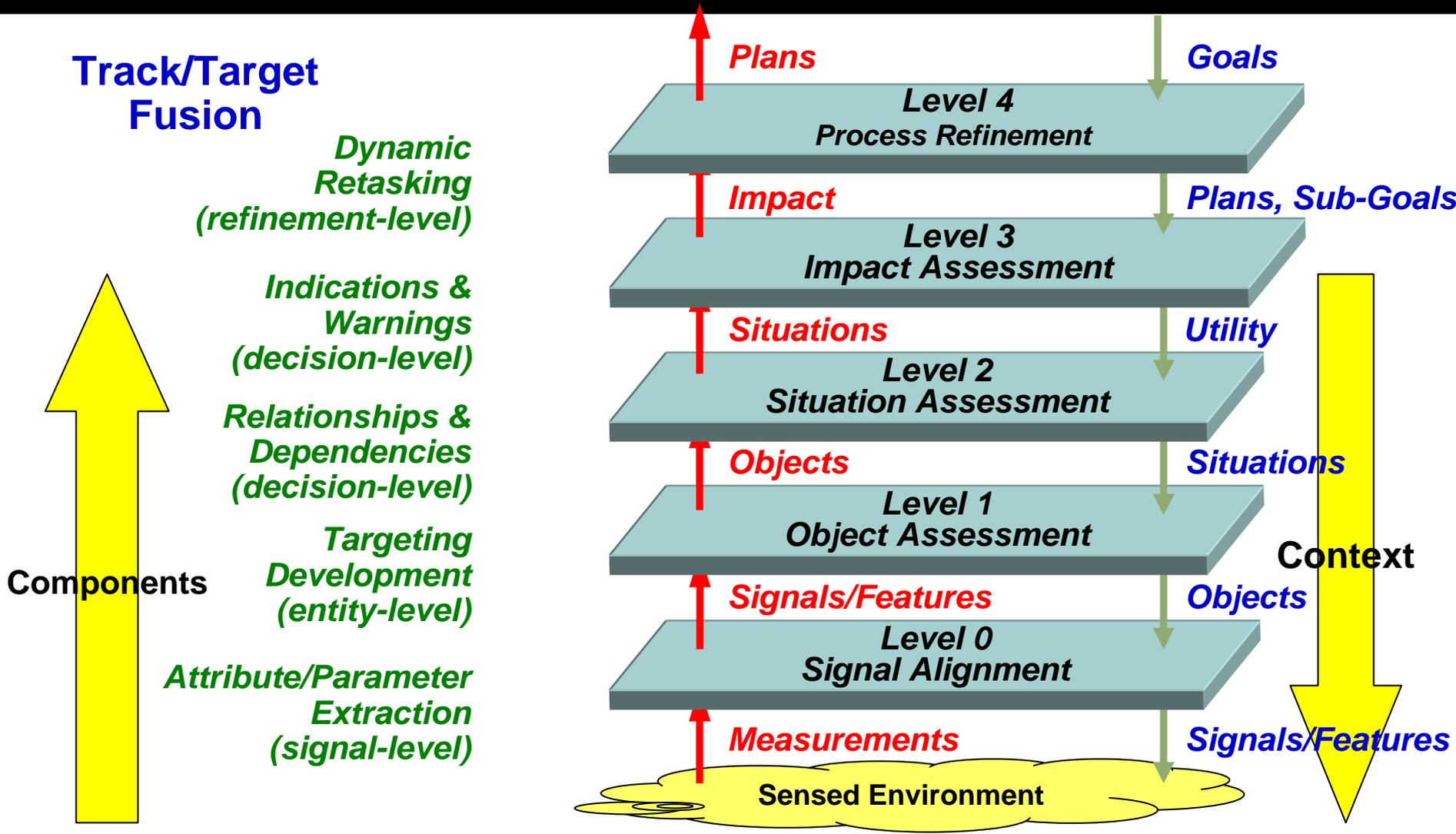


DATA:
*Observations &
Measurements*

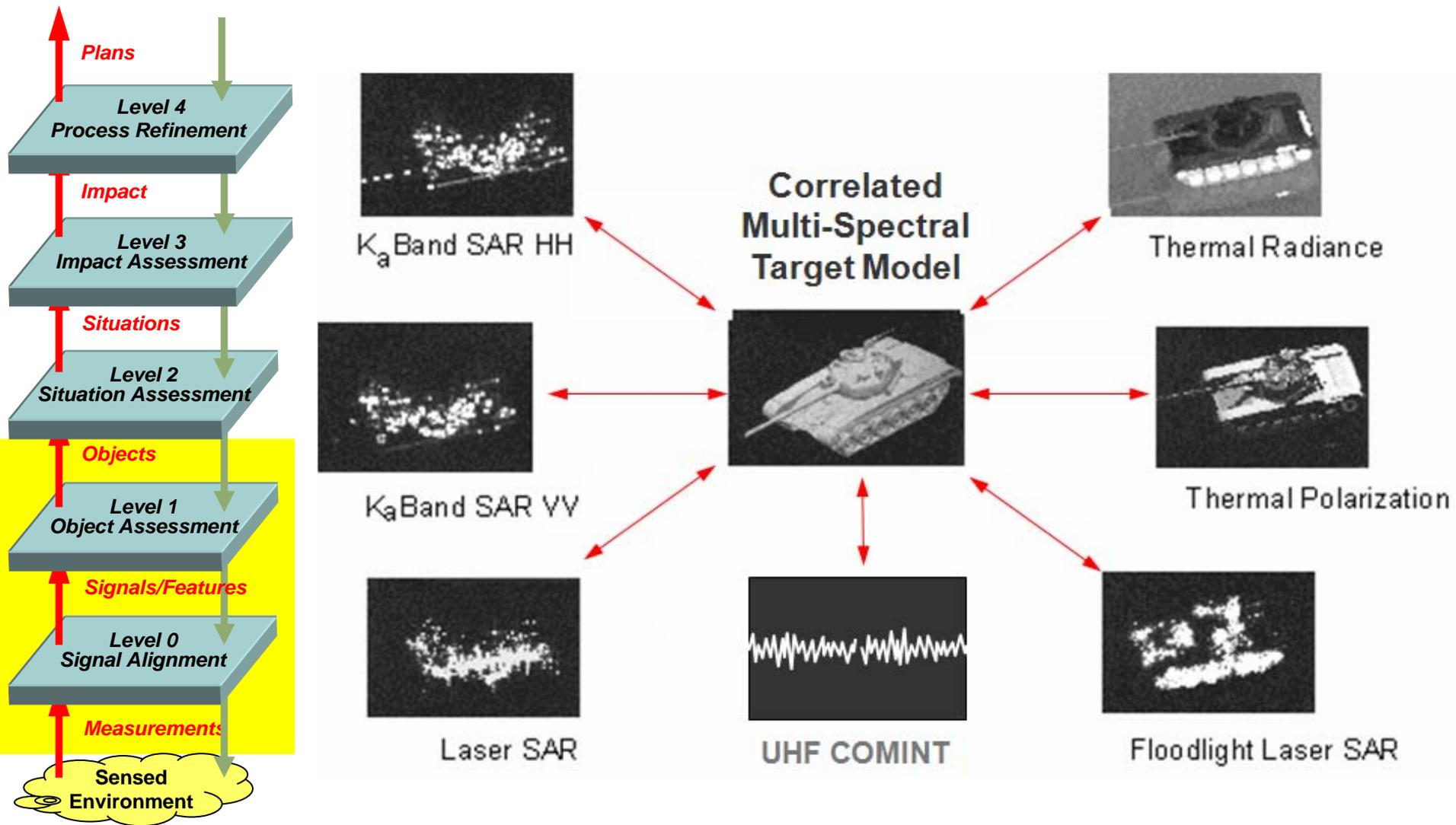


INFORMATION:
Organized Data

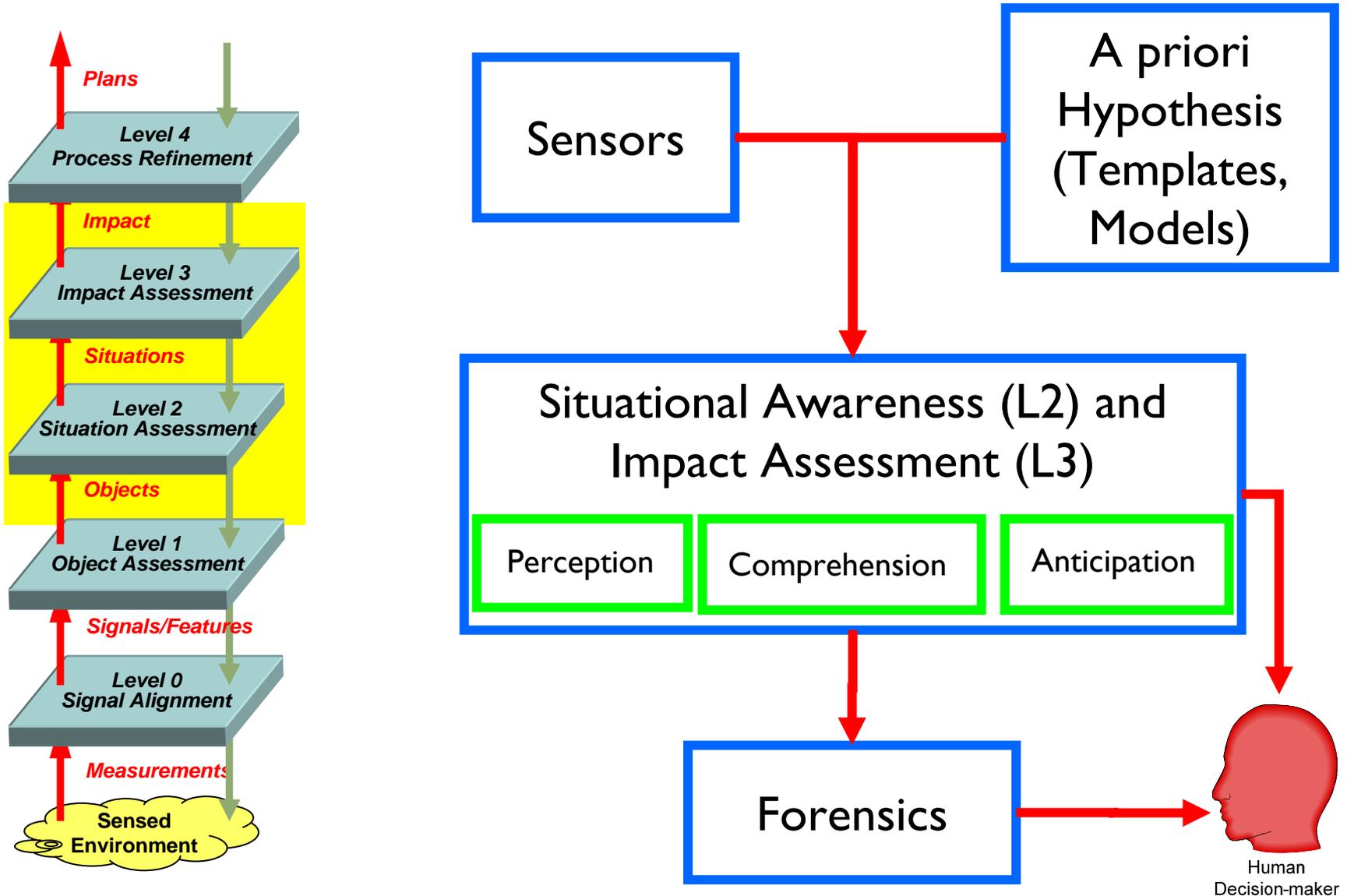
Logical Flow Across the JDL Data Fusion "Levels"



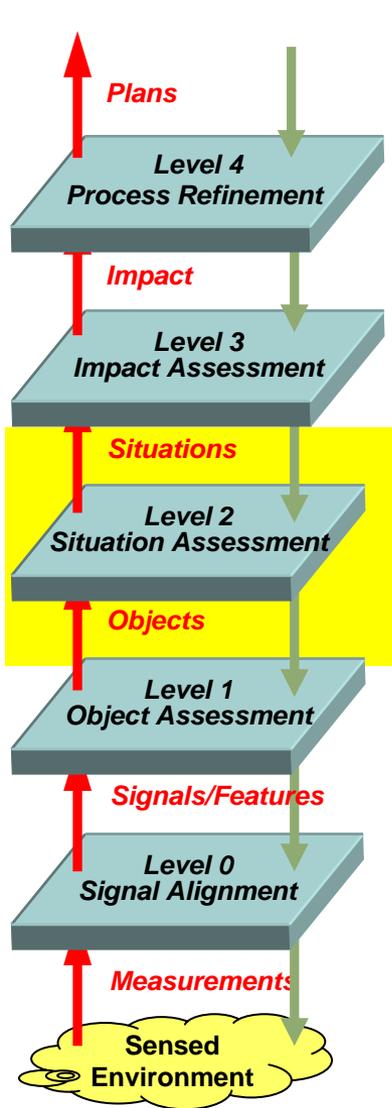
Sensor Detection (Object Assessment)



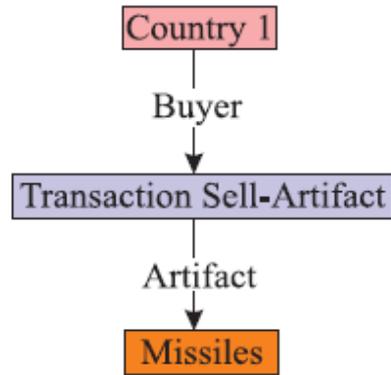
Situational Detection (Situation and Impact)



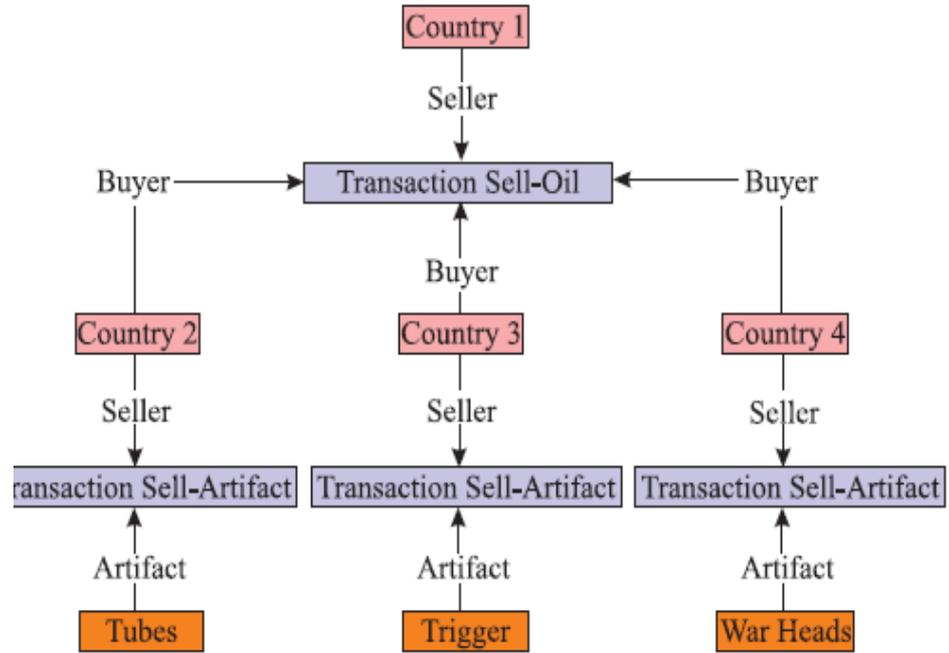
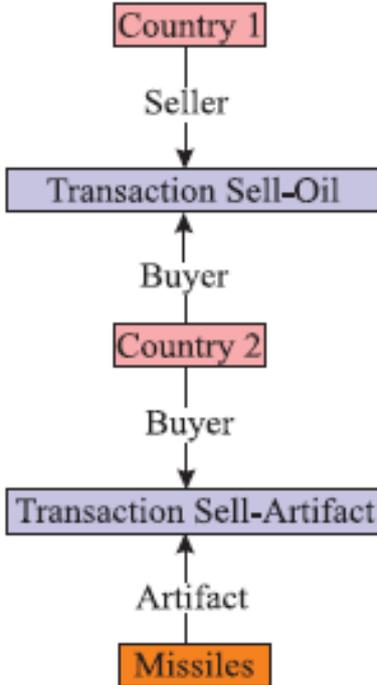
Situation Awareness using Graph Matching



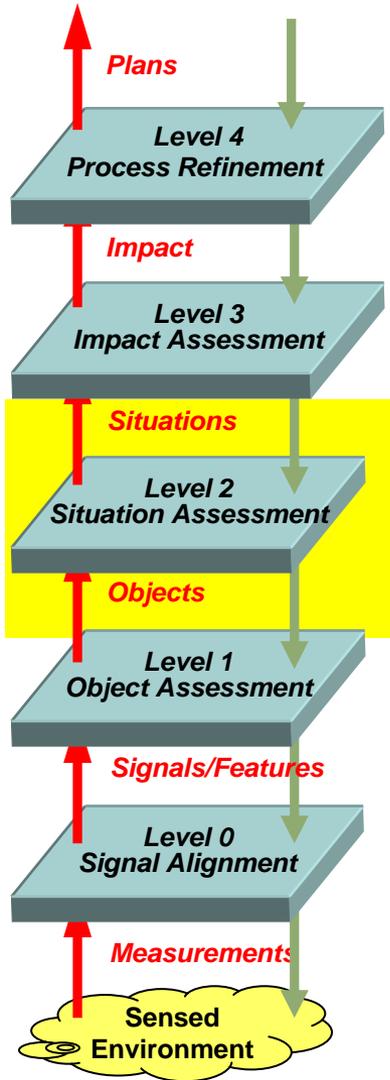
ISOMORPHISM



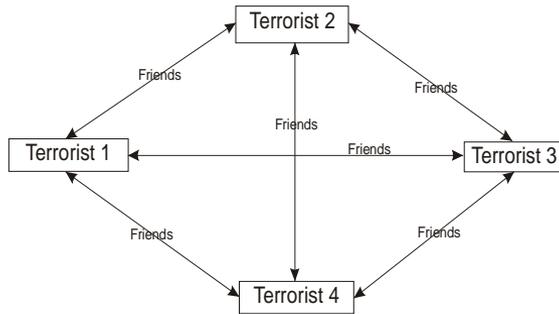
HOMEOMORPHISM



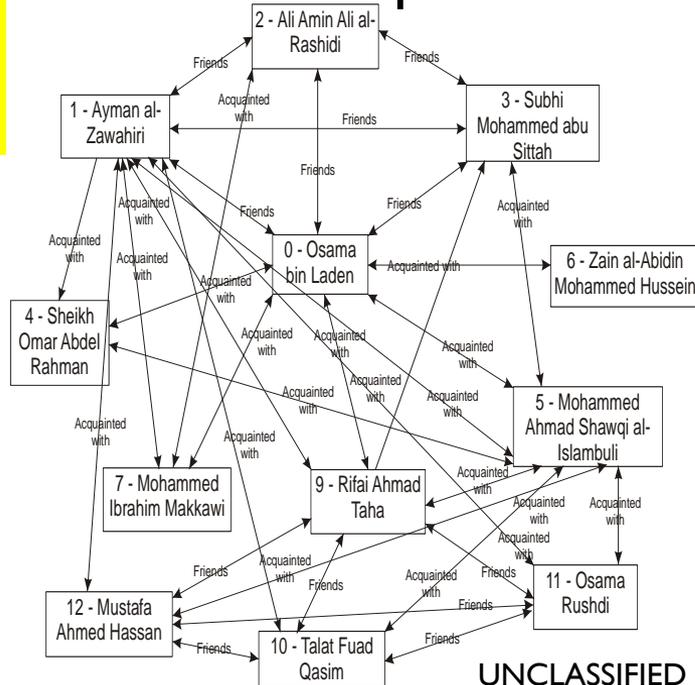
Bundling



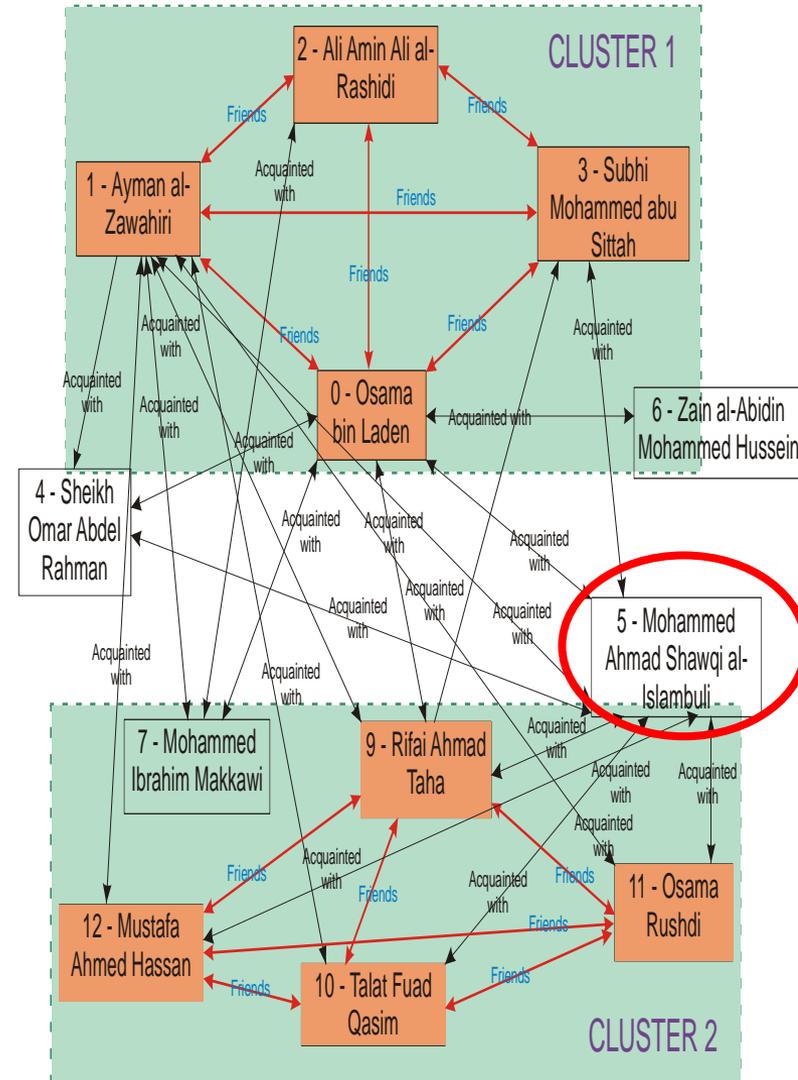
Template Graph



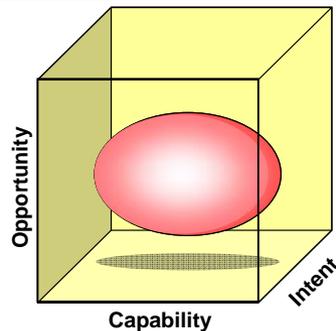
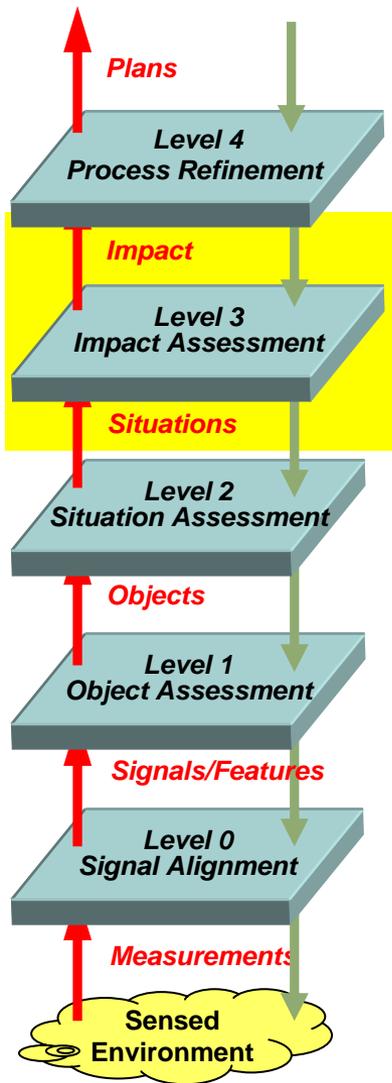
Data Graph



Hypercube Distance Clustering



Impact Assessment Analysis within a Constraint Environment



Nuclear Attack
Constrained Principally by **CAPABILITY**;
Secondarily by Opportunity



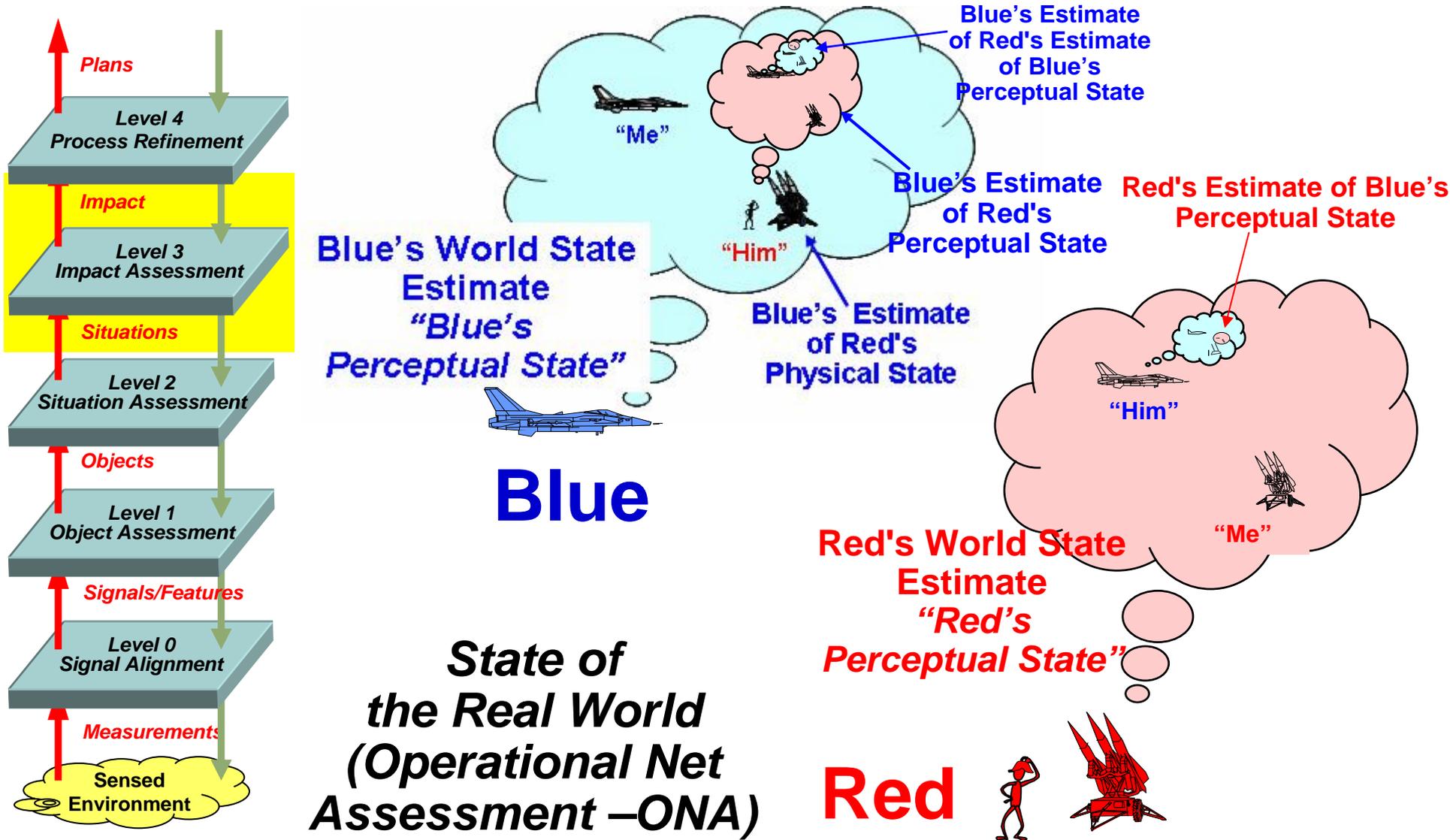
Political Assassination
Constrained Principally by **OPPORTUNITY**;
Secondarily by Intent

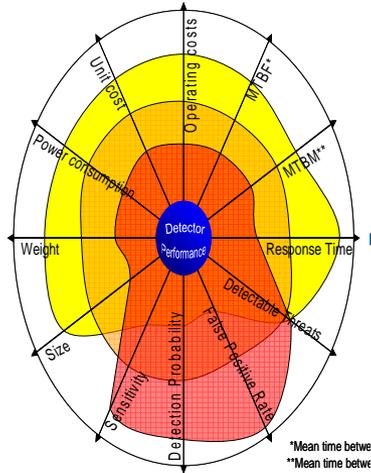
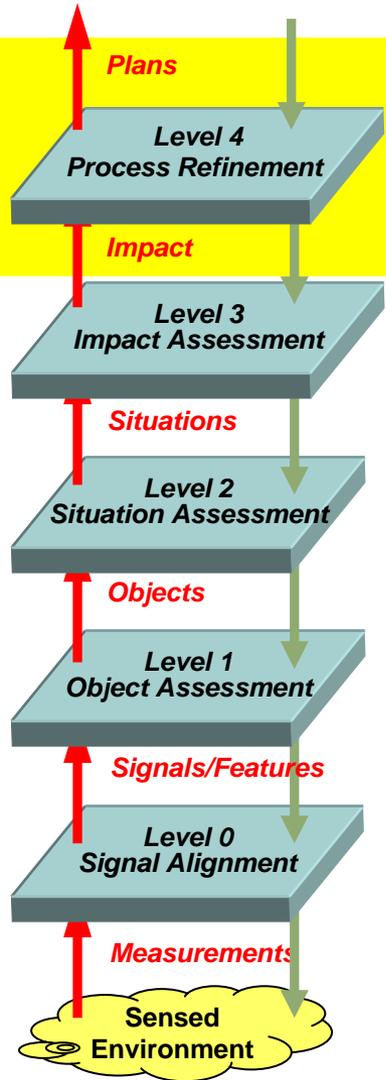


Improvised Explosive Device (IED)
Constrained Principally by **INTEND**;
Secondarily by Opportunity



Impact Assessment with Reasoning from Multiple Perspectives





Creation of Biosensor Ontology

- Class of Detectable Agents
- False Positive
- Spoofing Vulnerability
- Cost
- Response Time
- Power Consumption
- Sensitivity
- Pedigree
- Etc...

Mathematical Model

- Location of Sensors
- Type of Sensors
- Sensor Setting
- Batch vs. Real-Time

Process Refinement

- Optimal
- Heuristic

Where to locate,
what sensor,
with what setting,
at what time

- Situational Awareness and Impact Assessment is much more complex than sensor detection
- Contextual Information is critical in understanding Situations and Impacts
- Analysis must be done from Multiple Perspectives
- Solutions Strategies should be developed based on Human Cognitive Processes: Perception, Comprehension and Anticipation
- High Level Information Fusion is at its infancy