



SemanticFusion™

Situational Awareness in future

"...The SemanticFusion™ concept is based upon the idea that improved situational awareness requires improved high-level conceptual representations and reasoning capabilities. It approaches data fusion from an enhanced agent, ontology & concept-modelling perspective, rather than a traditional data-analysis approach..."

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SemanticFusion™ : Presentation Outline



Evolution of Situational Awareness

Next-Generation Situational Awareness

SemanticFusion™ approach to Situational Awareness

Leading-edge architecture and implementation

Live demonstration of Situational Awareness interactions between soldiers, sensors, UAV's and enemy forces

Defence benefits of a SemanticFusion™ technology approach

SemanticFusion™ :

Evolution of Situational Awareness



Review analysed:

- Literature
- Previous case-studies, POC & Pilot attempts
- Identified technology approaches used
- Results achieved

Review highlighted

- Not real-world scalable technologies or approaches
- Often fixated on one technology (i.e. Semantics)
- Approaches typically limited to Small POC's in Academic Research/Lab – ignored real-world scaling
- Usually constrained representational models
- Fixed & rigid – limited by a technology approach
- Difficult to integrate new sources or existing information silos
- Not really distributed or robust
- Not typically user friendly in terms of interaction or customisation

Review Identified

- Key changes in approaches and technology requirements required
- Viable Solution Architectures needed to both develop new technologies as well as needing to extend & combine existing technologies

We need Situational Awareness that is



flexible, targeted,
context-aware

- what combinations of info identified as relevant to me processed this way, displayed that way on this device - will help me or my companions - in my role, in this situation

distributed, extensible
& easy to integrate

- new info types and formats must be easy to add, easy to process and display new combinations, easy to integrate legacy sources, easy to integrate new sources in the field, is distributed and redundant and communications efficient

location, proximity,
and time aware

- what is happening or is relevant to me, to my unit, near or around me, is of interest to me now or in future, or has been happening over time and is of concern to me, understands behaviours over time

real-time , contextual,
decision support

- provides real-time updates to and from me, acts on my behalf monitoring many potential conditions of interest - that I specify, that my command specifies, fit a nominated category, and the info and my options are prioritised and presented to me in real-time in a way that helps, not hinders

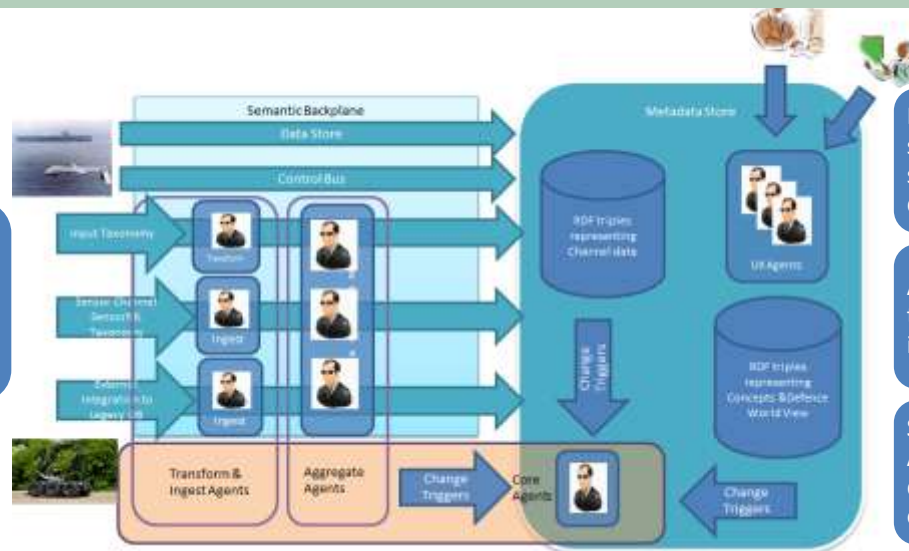
operates at multiple
levels

- facilitates integrating me, my companions, sensors, Autonomous vehicles and other resources - together as a close-knit team, as a small element of a larger force, and as part of a comprehensive, automated, battlespace automation / management / decision support approach.

SemanticFusion™ : Situational Awareness Concept

So we designed a flexible, scalable, distributed, platform that incorporates proprietary, agent, semantic, text analysis technology to do just that!

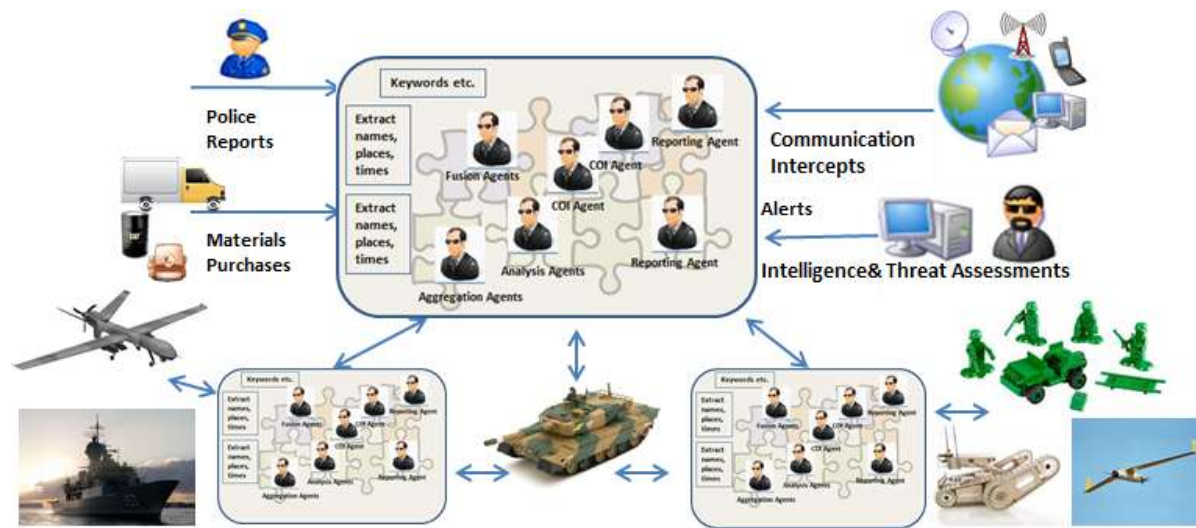
Plus it does significantly more!



Monitor suspicious events and signals – thefts, purchase of sensitive materials, comms keyword detections etc.

Agents cross-reference events, translate between concepts, and identify & update dependencies

Specific Condition-of-Interest Agents detect important or user defined event scenarios & trigger operator alerts or actions



SemanticFusion™ can integrate any information set in real-time

Works with concepts not as data - you understand and can describe scenarios and appropriate responses

Can Simulate, Predict, Monitor, is "Time- & Location Aware", & Plans - & can mix these

SemanticFusion™ : How Defence & Homeland Security Benefit from Concept level Scenarios

Extracts & works with high-level concepts

- Allows other information sources to be integrated and considered simultaneously
- Supports combined probability based on multiple supporting reports

Col example : the Condition of Interest model uses concepts and hierarchies

- if ANY enemy is within 1 km then SCOUT (general)
- if ANY enemy-tank is within 200 m then RETREAT (specific)

Intelligence Analyst COI's

- Monitor range of information sources to determine if Truck and Fertiliser thefts occur in nearby areas – could translate to a higher risk of attack in that general locality. Any nearby troop, vehicle, Government and Military Events will automatically be notified of increased risk.
- Notify Me if key-words, phrases, addresses are detected in email, or Radio traffic or Police systems.
- “Alert Me on Truck AND Fertiliser thefts inside a 10Km radius”

Potential to incorporate automated responses:

- facial recognition of a terrorist suspect in a subway locality, can trigger a request for police to apprehend, and trigger a heightened general subway monitoring level.

Homeland Security COI's

- Alert Me when ANY people .potential-terrorist cross VIC-borders OR enter public-areas
- when ANY people .potential-terrorist > 2 within 500m THEN Alert Me AND TASK NEAREST anti-terrorist-squad
- Alert me if COMBINED shipping -manifests for PORT-MELBOURNE within 5KM MATCH dangerous-cargo-combinations

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Simultaneous Real-time Demo & Mobile Device Displays

The HSR demo shows a “simulated scenario on screen”

- It shows a platoon, sensor, UAV, enemy forces & their location
- The combatants & their movements and status
- The Col's, events & responses in real-time
- A panel to trigger actions, like vehicle movements for each scenario

Plus system interactions with “Sarge's” Mobile Device

- Shows Platoon Status & Directions/locations
- Shows Sensor & Alerts - options for compass/Map overlays
- Shows list of Activated and Monitoring Col's (Sarge or C&C)
- Shows prioritised list of current and new Tasks



Demo Scenario

- Investigate sensor alert – triggered by enemy tank
- Trigger UAV Sensor flyover
- Detect “Hidden” enemy snipers and task to attack
- UAV then detects enemy Tank which triggers platoon withdrawal



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PlatoonLeader
LOC: 4QFJ 142 846

Team:

- Private 1 @ 87m NW
- Private 2 @ 70m N
- Private 3 @ 114m W

Sensors:

Alerts:
VEHICLE AT LOC: 4QFJ 152 840 BY AUDIO SENSOR

Task:
INVESTIGATE SIGHTING AT LOC: 4QFJ 152 840

COIs:
VEHICLE DETECTION

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Sensors:

Alerts:

Task:
INVESTIGATE SIGHTING AT LOC: 4QFJ 152 840

COIs:
TANK DETECTION
VEHICLE DETECTION

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SemanticFusion™ POC Scenarios

Scenario : Investigate , Shoot-to-Kill, “Run-Away!”

- C&C registers Col to have Platoon investigate ENEMY-VEHICLE observations
- C&C registers COI to have investigate ENEMY sightings
- C&C registers Col to have Platoon investigate ENEMY-COMBATANT observations
- C&C registers COI to have UAV scout area on SENSOR alerts of possible ENEMY-TANK sightings
- Sensor alert TASKS Platoon to investigate
- Confirmation of an ENEMY-TANK will triggers a WITHDRAW action



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Intelligent Information Access

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LOC: 4QFJ 142 846

Team:
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Private 3 @ 114m W

Sensors:

Alerts:
VEHICLE AT LOC: 4QFJ 152 840 BY AUDIO SENSOR

Task:
INVESTIGATE SIGHTING AT LOC: 4QFJ 152 840

COIs:
VEHICLE DETECTION

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SemanticFusion™ : Platform Capabilities



Enhanced situational awareness

- by providing contextually relevant information to users, in the right format, at the right time - to provide a real-time operational decision support system.

Context-aware integration of information feeds, sensor and external systems

- based on a conceptual (semantic) data fusion approach - operating over multiple analytical and representational levels.

Sense-Communicate-Act agent-based approach

- The combination of Agents, Semantics, Concept-Fusion and Conceptual Interaction Models supports our to representing, reasoning and responding to real-world information and events.

Built on an Semantic Agents / Communications core

- Monitor incoming information changes, triggering higher-level fusion and concept processing activities – driving appropriate responses and inter-entity communications.

“Conditions of Interest” (Col’s)

- A critical element is the use of user-defined and system-defined COI’s to trigger core system responses, and to automatically monitor and provide appropriate user alerts, displays.

Reduce operator fatigue and increase processing throughput

- Is achieved through tailored operator interfaces, Decision Support Col’s and text-analytics which automate many typical user analysis and alerting activities.

Real-time Semantically-enabled Planners and Agents

- Allow SemanticFusion™ to reason in real-time about certainty and time using the world sensor concept-model, unlike current fielded approaches – combining multiple information sources

SemanticFusion™ : POC Opportunities



Applications framework applicability to other areas:

- Defence Situational Awareness, Homeland security, Emergency services & disaster management, Police & Anti-terrorist response management

Localised (Soldier) Decision Support

- User Condition of Interest (Event Notifications)
- Information Visualisation
- Real-time sensor mapping & real-world minefield map & SemanticFusion™ visualisation of an immediate area
- Augmented Reality overlays (sniper positions, tripwires, sensor overlays of non-visible areas, etc)

Concept level data fusion

- Merge ELINT (Text reports analysis) with Sensor feeds, etc in real-time – to bias overall confidence and trigger appropriate behaviours
- Integrate multiple information sources and manage multiple/difficult “unknown classifications

Semantic Agent & Planner integration

- Logistics decision support
- UAV planning/visualisation support

Autonomous Vehicle Management

- Demonstrate interactive UAV and Col & Hierarchical planning/adaption based updated information
- Demonstrate environmental interaction with core and replanning actions - primary & secondary target selection
- Demonstrate Simple vehicle plans/logistics

Sense & Avoid

- Autonomous systems responding to “spontaneous inputs/sensor feeds and reacting accordingly

SemanticFusion™ :

Some Semantrix POC Opportunity Suggestions



Demonstrate real-time integration	<ul style="list-style-type: none">• Demonstrate real-time integration of multiple data sources and silos
Demonstrate automation	<ul style="list-style-type: none">• Demonstrate automation of high volume information processing to reduce operator cognitive fatigue – move focus to flagged high priority items and errors.
Demonstrate concept integration	<ul style="list-style-type: none">• Demonstrate concept (not data) integration across multiple disparate bits of information - to synthesise an accurate “big picture” overview
Demonstrate complex behaviours	<ul style="list-style-type: none">• Demonstrate the ability to integrate and reliably respond to complex event patterns in real-time for a complex monitoring situation with automated data feeds which would otherwise cause significant operator cognitive load
Demonstrate role-based access	<ul style="list-style-type: none">• Demonstrate role-based access to support multiple authorised user profiles and provide controlled access to allow controlled input, access, and visibility
Demonstrate Complex Interaction/response patterns	<ul style="list-style-type: none">• Demonstrate improved support for complex interaction and response patterns (hierarchies of Col’s & agent behaviours) – specified in terms of generalisation/specialisation of domain concepts (Chief, sergeant, private, vehicle ...)
Demonstrate contextual information integration	<ul style="list-style-type: none">• Demonstrate contextual information combinations related to simulation, enhanced analysis, planning/simulation support
Demonstrate bandwidth-limited communications	<ul style="list-style-type: none">• Demonstrate bandwidth-limited communications between distributed SemanticFusion™ “nodes”. For example - geographically distributed processing hubs, such as radar signal processing in Adelaide, satellite processing in Canberra, etc.

SemanticFusion™: Defence Benefits



Ingest intelligence from current and new sensors and sources

Understands and integrates location, proximity, sensors and ELINT

Distil data into concepts – describing “Conditions of Interest”

Expressed as Reasons which people can understand and use

Responses – Automated Rules or C³ - Layered Behaviours

Communicate to all Levels - Soldier up to Battlefield Management

Low-Bandwidth - Distributed Model – from Man Portable upwards

Bridges Legacy to Future Combat Warfare Models

Semantrix can help: Skills & Technologies

Key Technologies we can support include:

- Data and concept fusion – people work with concepts they understand
- Text analytics – extract who, what, why, & sentiment
- Semantic enrichment – extend content from new and legacy sources
- Concept-level Information representation, transformation, mapping and integration
- Complex real-time event processing and decision-making support
- Smart Reasoning and Search across multiple information types
- Integration of Artificial Intelligence, Knowledge—based systems, and Agent based technology approaches with Semantic and Text Analytic technologies – to provide leading-edge approaches to integrating, analyzing and interpreting structured and unstructured text and multimedia content

Business process driven, Semantic web-services and integration approaches

- Our partner TopQuadrant has been heavily involved supporting various US Defence information modeling, and integration projects

Semantic Web and Metadata related technologies and applications

- Enterprise or custom Search and indexing applications
- Catalogues and Online directories – ingest, transform, cross-ref, content enhancement and publish
- Contextual search & advertising – user personalisation
- Dynamic Semantic Publishing – smart analysis, cross-referencing, metadata tagging and automated publishing via our partner Ontotext

Semantrix principles and partners have been involved in:

- High-performance information and event capture, processing, storage, fusion, processing and display. etc.
- Real-time decision support in power-plants, instrumentation & control-systems, expert and diagnostic systems, mine equipment, etc.
- Operator information displays and processing in complex scientific instrument networks, radar systems, mine equipment, etc.
- Enterprise scale search, index and recommendation systems, text analytics and content analysis and cross-referencing, etc.
- 3D virtual reality and information visualization environments - mine sites, radar and instrumentation information displays, etc.

Situational Awareness and Network-centric warfare

- Combining a range of technologies and skills to deliver the information you need
- Integrating, analyzing, reasoning and presenting information in a way that makes sense to a warfighter role
- Information presentation in a form that meets users immediate needs – delivering superior situational awareness and decision making - without information overload.
- We can support Intelligence analysts through text analytics, conceptual search and information cross-referencing and automated filtering
- Semantic Fusion delivers enriched, targeted information to role-based analysts – assessing threats and supporting homeland security applications
- Integration of multiple sensors and disparate information sources, artificial intelligence approaches, and adds simulation/planning capabilities

SemanticFusion™ - Next Generation Situational Awareness and Concept level data fusion

- Integrates, interprets and distributes the relevant information – on the ground, and tailored to each warfighter role
- SemanticFusion™ provides enhanced situational awareness, emergency response, and simulation and planning capabilities
- SemanticFusion™ can be dynamically extended, can integrate new sensors, information, & displays, and can dramatically enhance R/T decision support

HSR: Health Sense & Respond™

- HSR provides the next-generation of medical decision support in the hospital or emergency or battlefield triage applications
- HSR is location and context-aware tying NFC/RFID tags, and smart information management together with real-time patient sensor & location monitoring, plus Text analysis of patient records, treatments, trends - to provide context aware “treater” decision support next to the patients bed on mobile devices.

SM3: Social and Multimedia Metadata Manager™

- SM3 is an Enabler for the Next Generation of Social Network Aware Intelligent Media
- Recommendation, Personalisation, Conceptual Search, Semantic Advertising and UGC System Integration.
- SM3 enables capabilities not available to traditional DAMS/VMS systems and emerging User Content systems.
- Analyse, Cross-Reference, & metadata tag, multimedia, security/UAV video, images, documents, reports etc. Links media assets such as video to other relevant media or text assets

Contact Semantrix for more details



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