

# Wave Exploitation Framework

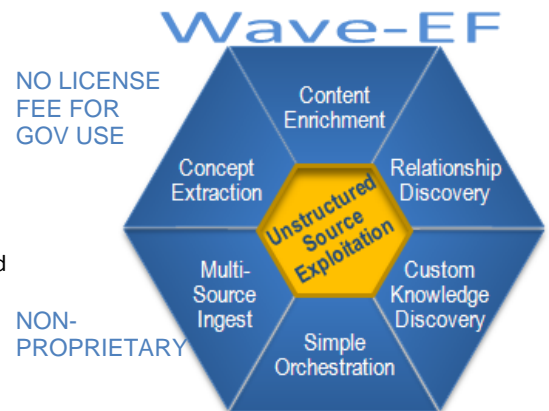


## Exploit Unstructured Intelligence Sources.

- ♦ Find and correlate essential elements of information buried in structured and semi-structured intelligence products.

## Supercharge the soft side of your analysis environment.

In irregular warfare, often the most valuable information for intelligence analysis is buried in unstructured, or soft, information sources. Modus Operandi's Wave Exploitation Framework (Wave-EF) automatically identifies key concepts and relationships in unstructured data, tags them, and feeds them to analysts' tools for correlation and visualization. Wave-EF frees analysts from tedious reading, markup and search tasks so that they focus on the big picture. By putting unstructured text on a par with more structured data, Wave-EF enables true all-source analysis.



## Complex Concept Extraction

Wave-EF extracts the following 14 essential elements of information (EELs):

persons	locations	communications	vehicles
organizations	groups	internet components	targets
activities	blue force	phone numbers	weapons
facilities	units	control measures	

Many basic text analytic tools concentrate on finding entities which are nouns. But that is not sufficient to extract the fundamental triad of intelligence fusion: **Entity-Location-Time**. Examples of this triad are when a High Value Individual was observed at a specific location and time, or a suicide bombing incident is planned to occur at a particular place and time.

Wave-EF takes extraction to the next level by treating these basic EELs as concept building blocks. Relationship extractors tie concept building blocks together to describe more sophisticated constructs such as events. An IED incident, for example, is a type of event that can be linked to numerous concepts, such as multiple persons, organizations, locations, and times; to descriptive signature concepts such as detonation method, explosive type, and concealment method; and to effects such as destruction and casualties.

## Content Enrichment with Semantic Tags

Content enrichment does for text what STP® Fuel Treatment does for gasoline—it makes the parts that consume it work more effectively. Content enrichment with semantic tags transforms unstructured text into content with meaning that both computers and humans can recognize. In a data mining scenario, these tags can be used by analysts to find specific intelligence products by searching for specific entities, for abstract concepts, or for relationships among entities that are contained within the product. In an alerting scenario, these tags can be examined by a semantic filter that determines whether the product is relevant to the analyst's expressed requirements.

All of the Wave-EF text analytic components produce annotations, or tags, which can be consumed by any other tag-aware components within the analysis ecosystem. These tags are saved in a separate repository as metadata, and can also be added back into the content to enrich it for downstream processing by other components. Content

enrichment makes more sophisticated automated capabilities possible, such as relationship discovery and custom knowledge discovery.

By associating extracted EELs with semantics via a formal ontological model, Wave-EF supports abstract concepts. Abstraction translates into more powerful search capabilities, so that analysts can ask about, for example, vehicles instead of enumerating all of the many possible types such as car, truck, van, bus, and so on.

The Wave-EF tags retain positional information (i.e., field F, character N) so that extraction components can divide up the work and share results. With positional information, components can then assess proximity of entities within the source text and reach conclusions. In a data mining scenario, positional information can also be used for more effective display of search results. The analyst can jump directly to the part of the report where the search term was found, see an excerpt of surrounding text to understand the context, and pick out related terms from the background by color-coded highlights.

## Automatic Relationship Discovery

Analysts want to know how people are linked to each other, to organizations, and to events. When those facts are buried within unstructured text, it is tedious and time-consuming for analysts to find and exploit them effectively. Wave-EF extractors are able to automatically identify some types of relationships, or links, among entities during the concept extraction process. An example of this first type is when a *person* is linked to an *event* via the relationship *actor*. Other types of relationships are determined with Wave-EF's machine reasoning techniques such as inferences drawn from extracted facts and by rule-based reasoning. An example of this second type is to assemble facts from different sentences, such as when the pronoun *he* is recognized to be the same as the person *John* in the previous sentence.

Wave-EF saves the relationship facts that it discovers in a data store so that they can be piped to a link analysis tool for visualization and review by an analyst. Since the facts are also related to the source report, an analyst can navigate directly from a discovered relationship to view the original text where that relationship was identified in order to review the accuracy of the automated discovery and to glean relevant information from the surrounding text.

## Add Smarts with Custom Knowledge Discovery Capabilities

New knowledge discovery algorithms and rules can be added into the Wave-EF framework to extend and build upon the out-of-the-box components. Examples include:

- ◆ Deal with fuzzy time concepts such as 'evening' and 'yesterday' to place events in order and compute tempo
- ◆ Recognize specific event types of interest such as vehicle theft, religious celebration, or kinetic event
- ◆ Identify what's new relative to an established pattern

Custom knowledge discovery exploits the concepts and relationships located and tagged by Wave-EF extraction components. They are the building blocks of knowledge discovery. Each atomic fact is represented as a triple for ready consumption by machine reasoning components. Wave-EF includes integrated engines that perform inferencing, rule-based, and probabilistic reasoning. Modus Operandi provides training and expert assistance to build additional capabilities.

## Multi-Source Ingest

Wave-EF ingests reports in .doc, .pdf, .rtf, .html, .xml and ASCII text. The interactive formatter tool quickly creates custom ingest parsers for binary and text formats, including the following:

- ◆ USMTF (all caps) messages
- ◆ NITF 2.1
- ◆ OTH-Gold

- ◆ 6 HUMINT report type
- ◆ NMEA Types 1-3 position reports

The ingested data is transformed from its native format to a neutral semi-structured XML format that is understood by all of the Wave-EF components. The interactive formatter tool makes it easy to teach Wave-EF's parsing components to understand a new native format. We add new ones frequently, so check the web site for the most up-to-date list.

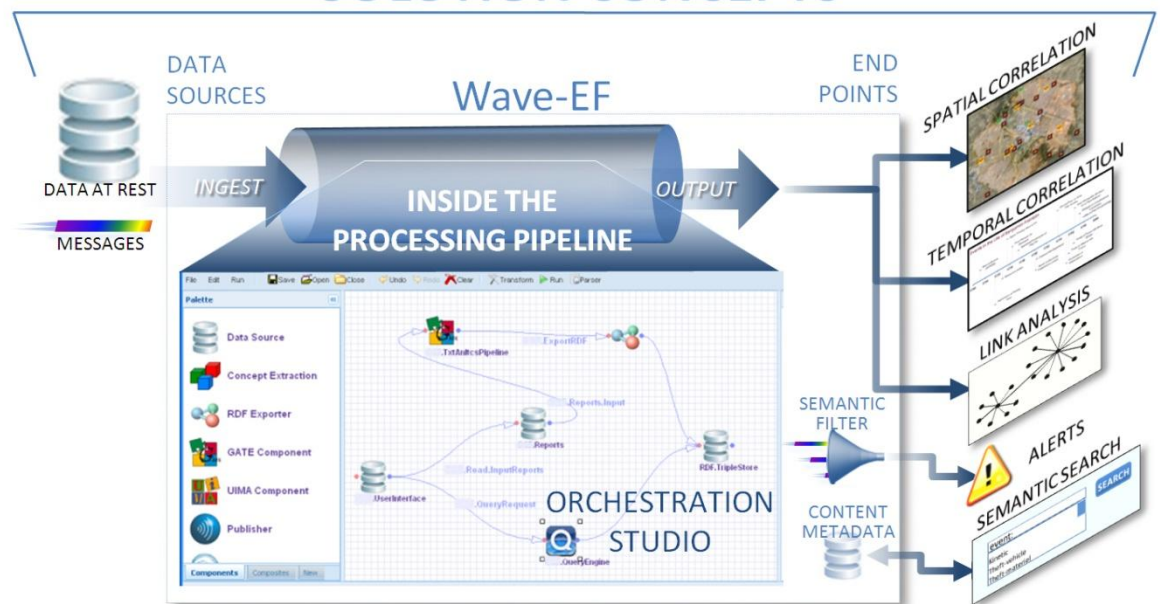
## Simple Orchestration

The Wave-EF Orchestration Studio provides a declarative interface for creating and managing processing pipelines composed of Wave-EF components. Each pipeline extends from data ingest through extraction and ultimate knowledge discovery, to the end points which store the information or feed it to external services or tools. Each pipeline expresses which components are needed, how they will build upon each other's results, and where the results will go. The Orchestration Studio marshals the necessary resources and creates a deployment-ready executable.

- ◆ Deliver solutions faster
- ◆ Adapt quickly to changing requirements

The first benefit of simple orchestration is that a Wave-EF solution can be delivered faster. After initial delivery, the orchestration capability pays off whenever the solution has to adapt to changing requirements. New data sources and formats, new entity types, new concepts, and more advanced knowledge discovery algorithms, can all be accommodated.

## SOLUTION CONCEPTS



### ABOUT MODUS OPERANDI

Modus Operandi is a software technology company focused on accelerating information discovery, integration and fusion for Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) customers in the defense and intelligence communities. Our advanced intelligence analysis technology enables military and government users to process enormous amounts of data in order to extract actionable intelligence used in the formation of tactical decisions.

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