



## I. Introduction

Bayesian Network technology is used to perform real world situation assessments, discern what is happening and evaluate alternative courses of action. The situations being assessed can include virtually anything from testing the correctness of medical claims to determining levels of potential terrorist threats.

Bayesian Network technology has held great promise for decades but its use in production applications was limited because it can easily become computationally intractable. Networks can grow very large very quickly and the real time data used as evidence to assess situations can be voluminous. Over the past 12 years IET has performed research and developed software solutions that successfully overcome prior computational limitations of Bayesian Network technology.

## II. From Research to Reality

Since its inception IET's mission has been to innovate and implement Bayesian technology based solutions. IET has evolved its Bayesian technology to where it is sufficiently mature to be labeled "production quality" and is used in solving a variety of real world problems in government and industry. Following are just a few examples from 2003:

- The Hercules Project within the Missile Defense Agency selected IET software and services for building a system to discern decoys and chaff from actual warheads in mid-course flight
- Digital Sandbox, Inc. standardized on IET software and services for their Site Profiler®, a software system used for security risk management
- Northrop Grumman selected IET to support them in their bid to win the Kinetic Energy Intercept Boost Phase Vehicle bid, which Northrop Grumman ultimately won and subsequently named IET as part of their team for future work.

## III. One Technology – Many Applications

IET's primary source of revenue has been performing government R&D for organizations such as the Missile Defense Agency and DARPA, however, that is inevitably changing as IET's Bayesian research, expertise and software have earned transition opportunities to commercial markets. Following is a partial listing of IET's current government and industry projects, all of which should transition to commercial applications:

- Résumé Assessment System – Under government contract, IET developed a prototype system that automatically assesses the veracity of résumé data. The prototype is limited to determining the probability of whether things like education and job timelines are truthful but it has the capacity to do much more such as determining "best fit" candidates for specific jobs and organizations. IET is currently in talks with a major Internet-based job board company for further development and production deployment of its résumé application.
- Medical Assessments – Just as IET technology can be used to assess résumés, it can also assess medical information such as in claims fraud and abuse. IET is currently in discussions with a commercial company that collects information on clinical trials and needs a way to rapidly surface issues associated medications and their impacts on patients.
- Cyber Forensics – Today, much of cyber forensic requires manual efforts by highly trained and experienced experts. IET is working with the cyber forensics unit of a large systems integrator to capture that expert knowledge and leverage it by incorporating it in a system for many to use.

- E-Learning – Distance learning or e-learning holds great promise for wide access, lower costs and just-in-time learning. However, adoption of e-learning has been slowed by high dropout rates and a one-size-fits-all mentality. Under contract to the Office of the Secretary of Defense, IET developed a prototype system that automatically assembles e-learning course content according to the learner's objective, the learner's current competencies and the course material at hand. The system can also dynamically adjust course content presentation based on the learner's progress while taking the course. IET is in talks with learning management systems vendors for commercial deployment of this technology.
- Network Security and Monitoring – A recurring problem with information network security and monitoring is the high frequency of false positive and false negative alarms. Under contract with the US Air Force Research Laboratory, IET is developing techniques and prototype systems that will be deployable within existing network security technologies to reduce false alarms.
- Distributed Intelligent Agents – The capability and speed of communications among distributed agents (e.g., people, machines, sensors) is growing exponentially such that now the challenge is how to digest and make sense of volumes of information for coordinated action. IET is under contract with several organizations to solve that problem. In one case, IET is developing the technology that enables literally dozens of unmanned aircraft to share their individual sensor information and share responsibilities for fulfilling their mission, whatever it may be. This technology has direct transferability to industries such as medicine, finance and telecommunications.
- Course of Action Evaluation – The greatest strengths of IET's technology are the abilities to perform situation assessments, create alternative courses of action and evaluate those courses using expert knowledge, prior data and real time data. IET systems also know what additional data can refine situation assessments and course of action evaluations, and can automatically ask for that data. IET is currently working with DARPA to dynamically build situation assessments and evaluate alternative courses of action for battlefield commanders in real time. This technology can directly transfer to the commercial marketplace for use in-line with other business intelligence technologies.
- Disparate Data Integration and Intelligent Search – IET is currently developing a system for dynamically combining dispersed and disparate data sources, and enabling intelligent search capabilities across those data sources as if they were one. This technology builds on and goes beyond work being done by the XML community. IET is currently in talks with a US and a Japanese company to deploy this technology in production mode.

#### IV. IET Technology and Services

The team at IET has been working with Bayesian Network technology for more than a decade and its patent pending technology has made dramatic contributions to driving the state of the art. Indeed, IET invented many of the techniques necessary for ensuring networks are computationally tractable, able to accept multiple real-time data feeds and process results for instantly taking action.

IET's named its product-line Quiddity\* Suite because it accurately describes what the technology does – finds the real nature of things. IET's technology is conveniently divided in two parts, services and software tools. The services consist of methodologies for things like knowledge elicitation and network modeling. The software tools consist of an inference and algorithms, modeling and scripting tools. The following graphic displays Quiddity\*Suite.

#### QUIDDITY\*Suite

##### quid•di•ty

(kwīdī-tē) 1. The real nature of a thing; the essence.

IET's Quiddity\*Suite complements and extends commercial Bayesian Network toolkits by providing methods and tools that support engineering large-scale, complex systems whose solutions must deal with real-world situations.

<b>APPLICATIONS</b>	<ul style="list-style-type: none"> <li>- Aerospace</li> <li>- Customer Relationship Management (CRM)</li> <li>- Energy Exploration</li> <li>- Financial Services</li> <li>- Homeland Defense</li> <li>- Human Resources</li> <li>- Medical Claims</li> <li>- Military</li> <li>- Pharmaceuticals</li> </ul>						
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## V. Packaged Solutions

IET has packaged its offerings to make it easy for prospects to understand and select the option that best meets their needs. The *Quick Start* program is designed to build a working prototype or proof of concept in just four to six weeks. *Production Implementation* is the next step and builds on the work done in Quick Start, refining it for completeness, accuracy and performance, and moving it into a production environment. In *Advanced Production Implementation* IET technologists extend the Production Implementation to provide greater functionality.

Feature	“Quick Start” Proof of Concept	Base Model Production Implementation	Advanced Production Implementation
Initial Consultation – Objectives Definition	√	√	√
Site Survey: Systems & Data Assessment	√	√	√
Schedule of Events & Deliverables	√	√	√
Knowledge Elicitation	√	√	√
Prototype Model Development	√	√	√
Test Data Extraction & Integration	√	√	√
Prototype Model Testing	√	√	√
Prototype Results Validation (Proof of Concept)	√	√	√
Base Model Construction		√	√
Integration with Internal Data Sources		√	√
Base Model Integration & Implementation		√	√
Base Model Testing, Validation & Refinement		√	√
Model Performance Tuning			√
Advanced Capabilities Model Development			√
Static/Dynamic Modeling			√
Batch/Real-Time Data Feeds			√
Output Data/Reporting Capabilities		√	√
Production System Installation		√	√
Production System Testing		√	√
Documentation: Models & Systems Configuration	√	√	√
Training: QUIDDITY*Suite			√
Technology Transfer: System Support & Maint.			√
Cumulative Elapse Time	4-6 Weeks	6-8 Weeks	8-12 Weeks
Cumulative IET Resources	1-2 People	2-3 People	2-4 People
Cumulative Approximate Cost	\$50,000	\$125,000	\$200,000