Finance sector application of the SATURN Intelligent Data Analytics and Visualisation Platform

A white paper by:
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Executive Summary

Originally launched to investigate advanced techniques for early detection and visualisation of cyber threats to the UK critical national infrastructure (CNI), the SATURN experiment is now a £3 million joint research programme. Using its industry-leading innovation facilities at Adastral Park in Suffolk, BT leads the programme in partnership with Northrop Grumman plc and Imperial, Oxford, and Warwick Universities.

Suitable for any information-rich industry environment SATURN offers exciting possibilities for new ways of analysing and visualising complex data. BT sees the finance sector as offering opportunities for applications ranging from market data analysis to sophisticated fraud prevention and identification of atypical customer behaviours.

The acronym stands for Self-organising Adaptive Technology Underlying Resilient Networks and it has delivered significant breakthroughs in artificial intelligence (AI) along with innovative methods for collecting and fusing data from disparate sources. SATURN has already been proven in applications ranging from BT security platforms to the prevention of cable theft.

For the UK government SATURN is a key innovation programme expected to deliver next generation CNI service management and risk analysis capabilities to the Centre for the Protection of National Infrastructure (CPNI). It is also attracting interest from other government agencies in terms of its ability to detect and visualise underlying relationships between disparate data sources.

ABOUT THE AUTHOR

Dr Robert Ghanea-Hercock is Chief Research Scientist at the BT Security Futures Practice. Part of the BT Innovate and Design division of BT Group, the Security Futures Practice is based at Adastral Park in Suffolk. From pioneering work in optical technologies and digital switching through to work in advanced software techniques and protocols, Adastral Park is renowned as one of the world’s leading technical innovation centres. The organisation employs around 4,000 people and embodies open innovation – using partnerships with customers, suppliers, partners, and academia to complement the value of BT research programmes.

“The finance sector use cases we’ve identified so far might only be scratching the surface. SATURN could powerfully extend our joint knowledge of what works and the art of the possible.”

Dr Robert Ghanea-Hercock
Chief Research Scientist
BT Security Futures Practice
Architecture for Innovation in Decision-Making

BT owns the intellectual property rights (IPR) for SATURN, which uses Artificial Intelligence (AI) to automate the collection, organisation, analysis, and visual modelling of information. Transforming decision-making, such visual modelling of complex data informs and complements human analysts’ expertise.

Key SATURN features include:

- An interactive self-organising data mining tool
- Ability to handle complex structured, semi-structured, and unstructured data, for example database, web, and social media respectively
- Low cost data analysis and visualisation capability
- Automatic subscription to data feeds to ensure information is always up-to-date

The high-level architectural model is shown in Figure 1. Based on novel AI guided search and adaptive visualisation techniques and technologies, SATURN is able to integrate multiple data inputs and data type processing and offers the ability to use advanced semantic data matching techniques.

Web-based visual analytics

SATURN supports the following processes:

- Security operations with situational awareness, data integration, data correlation, and visual data mining
- Self-organisation of heterogeneous data
- Map view allowing location sensitive incident tracking
- Modelling of interdependencies between various critical national infrastructures
- Input support for a variety of data formats
- Entity-extraction (including place names) and keyword extraction/annotation capability for unstructured text
- Geo-coding of place names and geographical views to render data in real time
- Visual semantic clustering of data and ability to classify clusters into a user-driven taxonomy
- Automatic classification of data

Invaluable in allowing analysts to see relationships between diverse data from different sources, Figure 2 provides an overview of the SATURN conceptual model. It shows how raw data is processed into valuable relational information, using visualisation techniques in support of more effective analysis and decision-making.

Figure 1: SATURN high-level architecture

Figure 2: Overview of SATURN conceptual model
Potential SATURN Application Areas for the Finance Sector

Brief descriptions of four existing areas in which SATURN is already being deployed are provided on the following pages. While current use cases are largely in the CNI area, it does not take a great intellectual leap to see how such in-depth analytical and visualisation techniques could quickly be applied to finance sector issues and opportunities.

Financial markets and the financial services industry already make extensive use of data analysis for competitive edge, security, compliance, and governance (both regulatory and corporate). The SATURN opportunity might be to move from decisions made on an understanding of what’s happened, to using predictive modelling to judge what’s likely to happen in the future. That could have applications in areas as diverse as new product development, understanding group and individual customer profitability, and operational and market risk management.

There’s a wealth of unstructured data in most financial organisations creating a great opportunity. The integration of that information with traditional structured data sources offers almost unlimited potential. The research team is keen to engage with financial institutions interested in exploring the possibilities. The following paragraphs form a non-exhaustive list of areas in which we envisage the tool could be used.

### Market risk analysis

Market risks run from understanding consumer debt default, to trading exposures for Basel III, to insurance companies’ Solvency II issues. Largely structured data, in the sense that it’s captured at deal closure or contract issuance, allocating the right degree of risk to it can be seen as an art rather than a rigid science. And how would it be if market risk ever appeared fully allocated on the balance sheet? SATURN may offer a way to analyse what’s going on, better understand risk, and find new ways to mitigate it.

### News data aggregation, filtering, and visualisation

Financial traders, naturally information-hungry, tend to rely upon their favourite news sources but may miss connections between disparate items of data. Seemingly insignificant on their own there may be hidden value in the confluence of separate items of information. News and data aggregation services are available, certainly, but how much better if we could use SATURN to map events together in real time and present them as highly-marketable visual intelligence?

### Trading pattern mapping

The ebbs and flows of transactions in FX and stock markets carry with them an understanding of the changing patterns of the global economy. While the content of those transactions is inviolable, might there be intelligence in their transport? Almost like learning about a social scene not by overhearing individual conversations but by knowing who’s talking to whom and how often. SATURN could analyse transactional meta-data for unusual patterns as much for warning as for profit. Certainly interesting at the macro level, it would be intriguing also to think about micro analyses such as asset class and liquidity implications.

### Geo-political analysis support

Similar to its possible application in trading pattern mapping, SATURN could take feeds from regional and country meta-data sources and provide invaluable early warning of potential political and economic shifts. That would certainly not be a real time exercise, but might nevertheless be invaluable in planning trading strategies.

### Social media analysis

An area where we are currently only scratching the surface, social media is a potent source of unstructured and semi-structured data that has the potential to transform areas as diverse as banking product development and measuring brand awareness. Visualising trends and consumer attitudes, SATURN could provide insights that marketers might until now only have dreamed about.

### Stock and financial data visualisation and analysis

Information providers have got this area down to a fine art. The trick they might be missing is combining traditional analytics and metrics based on market data with other less obvious data sources. SATURN has the potential to provide a more holistic view with surprising implications for people at the trading floor sharp end.

Naturally, the above is a speculative list only, and other relevant or related areas may well occur to the finance sector readership of this white paper. Therefore, we would like to hear from organisations interested in exploring SATURN opportunities with us.

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**BT FOR FINANCIAL SERVICES**

The global financial services sector is hugely important for BT. Our Global Banking & Financial Markets (GB&FM) unit brings together our global teams working across banking, financial markets, insurance and payments. It has helped BT become the number one provider of network-centric IT services to the sector. Teams within the unit are sharply focused on sub-sectors such as retail banking, wholesale banking, financial markets, and payments. Some 2,000 people work in BT global banking and financial markets, providing in-depth subject matter expertise.
Existing SATURN Application Areas

Cyber Security
BT has invested in the integration of SATURN into its existing BT Cyber Assurance platform for advanced security analysis and visualisation. The ability to integrate multiple disparate data feeds (over 15 in this case) includes a range of intrusion detection systems, deep network packet capture devices, log files, and asset and reference data. This enables automatic clustering of cyber threats based on source, destination and type of attacks. Figure 3 shows how visual analysis of this information allows organisations to understand quickly the source of threats and take action to mitigate them.

Network Alarms and Faults
A preliminary set of experiments was performed to test the SATURN tool on network faults and alarm data from BT Operate. As depicted in Figure 4 it enabled the creation of a fault hotspot map to be created in near real time from live network management data feeds.

Metal Theft
BT researchers developed SATURN technology to deliver a smart incident analyser for the BT cable theft task force. The system copes with different data input formats, enabling automatic geo-tagging of incidents to be presented visually in a way that shows the relative cost and customer impact of each crime. It enables rapid analysis of trends and developing hotspot areas allowing a faster, more targeted response, as shown in Figure 5.

Supply Chains
SATURN has recently been used to visualise supply chain systems for a leading global vehicle manufacturer as shown in Figure 6. Proposed research scheduled for November 2012 will look into investigating its ability to detect emerging threats to supply chain operations in real time.

Figure 3: Example screenshot from SATURN based on malware data analysis showing multiple overlaid views

Figure 4: Example visualisation of network fault hotspots for BT Operate

Figure 5: Example hotspot analysis of copper cable theft data

Figure 6: Geo-plot view of a data sample from an automotive supply chain network using SATURN
Summary

SATURN is an experimental system that has demonstrated innovative advanced techniques for the analysis of data in a wide variety of applications. The work so far has proved it to be a versatile platform offering tools for the intelligent visualisation of data. The key to this value lies in the use of a flexible, modular architecture based on an underlying AI engine, driven by heterogeneous data flows.

Designed as much to augment existing tools as to replace existing systems, SATURN can be integrated into either offline data analysis or real-time data flows. Future development of the platform will build more predictive analysis capabilities and will enhance the visualisation techniques available to the end user.

BT is interested in talking to finance sector companies about how we can work together to develop SATURN technology to bring value to their organisations and their people in unexpected and innovative ways.

Please feel free to contact Michael Cooper michael.cooper@bt.com to start that conversation.

“The system is fast and flexible and took just eleven weeks to deliver. It will be a powerful addition to the security measures already in place to help prevent cable theft.”

Luke Beeson, General Manager, BT Security