



Graph technology: Modernising tax administration and CX at HMRC

For HMRC to continue refining — and redefining — what it means to be a trusted, modern tax administration in the digital age, the ability to access and act on real-time information is key. But enabling improved outcomes such as faster fraud detection and giving customers a simple, even-handed, professional experience requires a resilient and secure tech infrastructure.

In that context, focussing on managing the technological risks around data security and exploitation is the right approach. To push on, however, the opportunity should be taken to build on this base layer of readiness to increase fraud detection capabilities, improve cyber defences and strengthen real-time data querying. HMRC could then recoup more revenue to invest in data management and digitalisation.

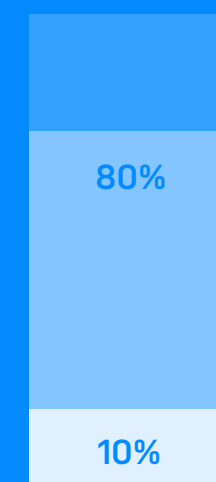
Neo4j's graph data platform is already helping HMRC with entity matching to reduce errors in tax collecting. Early-stage talks are underway around fraud detection. And there is also a growing skills community at HMRC.

But we can achieve something greater, together.

Neo4j: built from the ground up to leverage relationships in data

Neo4j is a native graph data platform — meaning its native storage layer is a connected graph — designed around a simple yet powerful concept. Each data record, known as a node, contains direct pointers to all the other nodes that it's connected to. All information needed to find relationships between nodes, or the next node in a sequence, is available in the node itself.

The result? Neo4j doesn't need to compute the relationships between your data at query time. That means queries of densely connected data are executed orders of magnitude faster than relational databases, which must repeatedly look up each connection.



Gartner predicts that, by 2025, graph technologies will be used in 80% of data and analytics innovations, up from 10% in 2021, facilitating rapid decision making across the organization.¹

The power of graphs in government and financial services

Governments around the world already use Neo4j's graph data platform to fight crime, prevent terrorism, improve fiscal responsibility and provide transparency to their citizenry, by connecting data from different agencies and departments.

And major financial services organisations — from banks to insurers to fintechs — use Neo4j to look beyond individual data points to the connections that link them, helping to uncover difficult-to-detect patterns indicative of fraud.

Achieving these outcomes with traditional, two-dimensional databases is challenging. Columns and rows lack the depth and capacity to correlate multiple sources or understand the relationships between them. In contrast, a graph data platform can model complex networks of entities and their interrelationships. This reveals patterns that may be impossible to detect using traditional representations such as tables.



Neo4j use cases in production at HMRC today, and tomorrow

HMRC already uses Neo4j for entity matching to accelerate the identification of organisations and individuals and the connections between them. Refining HMRC's massive amounts of data into unique entities and segments will allow you to better understand operations, customers and their behaviour. This use case also offers a pathway, via graph-enabled supervised machine learning, for maturing from hand-crafted queries based on business logic to AI-powered, dynamic entity resolution.

Yet this only scratches the surface of available opportunities to use the same data to drive additional value with graph technology.

Potential future use cases include:



Automate tax evasion detection, accelerate investigation

The Neo4j graph data platform provides the ability to quickly store and query large, complex and evolving datasets. This makes it the ideal foundation for alert systems that automatically identify graph patterns deemed suspicious by HMRC, dashboards that streamline the review of flagged cases, and graph visualisation interfaces that accelerate investigations.



Stronger cyber defences

By viewing its network as a graph, HMRC could think like a cyber attacker and level the playing field. With a complete graph of your infrastructure, you can adopt an enhanced security posture and pave the way to creating a digital twin for network monitoring that gives hackers nowhere to hide.

Graphs: the future of AI at HMRC

Knowledge graphs are the next frontier of leveraging AI to provide value at HMRC.

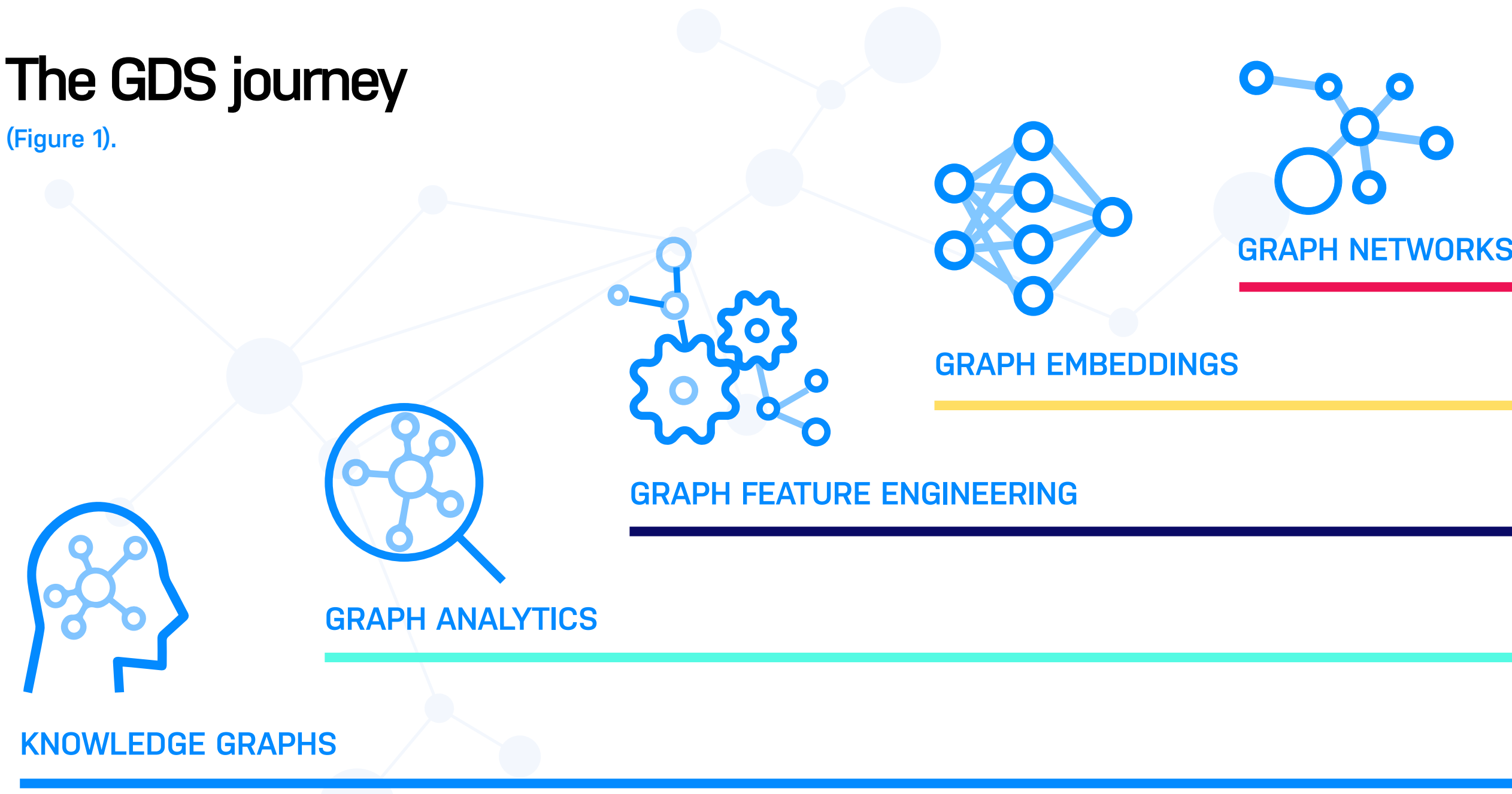
Datasets featuring relationships enable machines to incorporate human-like expertise and reasoning, to drive meaningful decisions and bring context to AI applications. This enables what Deloitte describes, in Knowledge Graphs for Financial Services, as a new wave of AI, focused on hybrid intelligence that fuses learning (data) with reasoning (knowledge)."²

Neo4j's graph structure is uniquely suited to evolving machine learning at HMRC. Your knowledge graph applications in use today, although powerful, are only the first step on the journey towards faster fraud detection, more responsive customer experiences and more robust risk management (see Figure 1).



The GDS journey

(Figure 1).



After implementing knowledge graphs, organisations often start using graph analytics to understand their networks better and answer specific questions based on relationships and topology. The ability to infer meaning based on network structure — finding clusters, identifying influential nodes, evaluating different pathways — makes for powerful predictive capabilities across multiple use cases, from tax evasion detection to anticipating customers' needs.

Relationships are extremely predictive of behaviour and they inherently exist inside current data. That means graph feature engineering will enable HMRC to improve predictions and increase machine learning model accuracy with the data it already has.

Finally, at the bleeding edge of graph technology research, graph networks and graph native learning promise to free data scientists from tediously selecting and testing potentially predictive data, by reducing data requirements and automating the identification of relevant features.

HMRC already has a live Neo4j graph data platform deployment. Want to learn more about how this graph technology can help you get deeper insights from your existing data, faster and more cost-effectively?



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