**Reimagining justice information systems**

By Paul Wormeli

New and updated technologies are making it possible to radically redesign integrated justice information systems to achieve many of the long-sought goals for a consolidated and enterprise-wide view of justice operations and management at both state and local levels. Particularly at the county level, consolidating justice functions for law enforcement, prosecution, courts, and community corrections is the most valuable space to reconsider how information technology can help organize, manage, and improve justice operations through the administration of justice. This article seeks to describe ways for modern components to be applied in concert to achieve many of the goals that previously have been difficult to achieve with conventional system architectures.

**CJIS Beginnings**

Criminal justice information systems began to appear in the last third of the 20th century. The early efforts were mainly pursued to help the multiple agencies in counties share computer resources. These systems were often designed to provide functionality to individual agencies—sheriffs, prosecutors, courts, jails. In many cases, the resulting systems were actually collections of silos rather than fully integrated applications sharing a cohesive common database. In most cases, these early systems were very document intensive, creating such outputs as crime reports, arrest charges, court filings, sentencing outcomes, etc. The lack of data standards impeded more extensive interaction across organizations and agencies.

As individual justice agencies required more functionality and justice executives argued more for control over their systems and ownership of the data that was collected, software applications were developed to provide specific and more robust services in the form of law enforcement records management systems, prosecutor and court case management systems, jail management, corrections management information systems, etc. Justice agencies began to acquire their own dedicated systems with little regard for the workflow of the entire justice enterprise. Based on this trend, jurisdictions began to implement criminal justice information systems by adding messaging capabilities to transfer documents electronically or just providing limited access to files by external users.

However, in many jurisdictions, this trend did not lead to any interaction between the silos built in the various justice agencies. Documents were printed, and hand-carried between agencies, where the data from the document was re-entered in the next system following the established workflow. This rather common architecture led to substantial duplication of data entry, the introduction of transcription errors, and delays in executing workflows, such as the time it takes to proceed from an arrest to arraignment.

As the technology evolved, some jurisdictions invoked the idea of data warehouses, where there was a consolidated database across multiple agencies and a greater degree of interaction across the justice enterprise. Many jurisdictions were not able to afford the expense of such systems or the effort to maintain data integrity across the multiple original sources of data coming from the dedicated individual systems.

As agency executives and policymakers, as well as the general public, became more focused on using data to inform decision-making and sought ways to develop evidence of agency effectiveness or the lack thereof, the independent silo collection of justice systems failed to meet these demands. Jurisdictions began to create portals and dashboards to attempt to integrate data from disparate systems.

**Unfulfilled ambitions**

While the efforts to build integrated criminal justice systems helped make progress in the understanding of the linkages across justice domains, the further sophistication of specialized software made it more complicated and expensive to link systems. The desire to have a robust and extensive ability to track offenders through the system, to explore the relationships between the various components of justice, to identify and overcome roadblocks to improve efficiency, and other visions for a true justice information system went unfulfilled. In many cases, the interaction between law enforcement and prosecutors remained on paper, where the arrest charging documents were printed and hand carried to the prosecutor’s office. The resulting duplication of data entry and the potential for errors limited the quality and completeness of the final information structure. Just the delay in awaiting the transfer of data in this kind of physical model increased the cost of the entire Justice enterprise.

Some of the unfulfilled ambitions for a complete perspective on the justice enterprise were rooted in the limitations of software and the capabilities of interoperability functions. The impediments to a truly integrated view of justice were impeded by the lack of data standards for facilitating interoperability across systems, by the prevailing architectures of centralized relational databases, by the focus on documents as the medium of data exchanges, and by the ubiquitous drive toward centralized data warehouses.

The Urban Institute has computed, based on U.S. Census data, that counties spend an average of 19% of their total expenditures on criminal justice activities.[[1]](#footnote-1) As a result, county executives and boards of supervisors are obviously interested in finding ways to make the justice process more efficient and effective while preserving the integrity of the justice information system that is required to support the work. A robust and fully integrated enterprise information system is the source of the data to make such improvements.

**The next generation**

Information technologies developed mostly in the last decade can be integrated to provide an architecture for an enterprise justice information system that can fulfill the most cherished ambitions. With the advent of these contemporary technologies, their combined capabilities make it possible to track offenders through the justice processes, evaluate the contributions and obstacles of each process with respect to the overall purpose of the enterprise, highlight problem areas, evaluate the contribution of specific programs and projects toward achieving the goals of justice, and all the while reducing costs and minimizing delays in the administration of justice.

With today’s technology, the justice enterprise can be represented as a series of events connected by the processing of an offender/defendant through the administration of justice from the point of arrest to the conclusion of community supervision. This perspective lends itself well to the use of a knowledge graph to reference the data contained in the disparate systems found in law enforcement records management, prosecutor and court case management, jail management, and probation management. Knowledge graph technology facilitates the creation of a distributed system where a federated query can assemble information without having to store all data in a single repository.

With modern infrastructure mostly derived from internet-based systems, today’s system can be built to run either on-premise or in any standards-based cloud. By using national standards for the ontology of the knowledge graph, we can control and simplify the exchange of data between the various sources of data, and by including powerful AI-based tools for entity resolution across all sources, we can ensure accurate and complete linkage of person as well as case management data across the entire justice enterprise. Under this model, and with the aid of an ontology derived from national data standards, we can use generative AI to enable the formation of natural language queries that are translated into the standard language for knowledge graph access to find patterns and unrealized linkages.

This model allows each contributing participant (law enforcement prosecutor, courts, corrections, public defenders, etc.) to acquire their own dedicated information system with whatever functionality they require and have it loosely coupled into the data fabric that is created to link all the data sources as needed to vastly improve data access, timeliness, and solve many of the shortcomings of previous justice information systems.

The specific technologies and their contribution to this overall goal that combine to achieve the objectives include:

1. Event Driven Architecture (EDA): Partner agency systems can send and receive data on a variety of protocols. The EDA is triggered by events such as a new arrest, case update, etc. Each event is processed through configurable event policies and configurable business rules, and subsequent events and actions are automatically triggered.
2. Knowledge Graph: The knowledge graph acts as the Operational Data Store (ODS) for the EDA. The EDA executes a store and forward mechanism, where each event passing through the EDA leaves its imprint on the graph. That way, the knowledge graph provides a longitudinal view of persons and cases across the justice ecosystem, and drives the justice hub portal with a variety of use cases. The knowledge graph can also include remote nodes, which are pointers to remote data objects sitting in external databases or behind API endpoints.
3. Entity Resolution: This AI-based system connects persons and their identities across the criminal justice landscape and generates a Friend-of-a-Friend (FOAF) network, even with imperfect person data in various partner agency systems. This component makes name matching across systems work reliably even without any biometric identifiers available.
4. Justice Hub portal: This is a single point of access to data across the justice ecosystem. It includes advanced person and case search, event timelines, detailed case information, court calendar data, and an AI-based chatbot that answers natural language person or case-related questions and provides summary reports.
5. RESTful NIEM APIs: These APIs follow the NIEMOpen taxonomy and enable different applications to interact with the knowledge graph in a simple manner while adhering to national standards for terminology. These APIs support the Justice Hub portal but can also support other apps and portals if partner agencies seek to build them. These components of a modern justice information system are linked together as shown in the following diagram:

A diagram of a computer system

Description automatically generated

Justice Information System Architecture

**The value premise**

With this major revolution in how to create and implement a justice information system, states and counties can use this technology to provide substantial value to their justice stakeholder communities. From the perspective of information technology, immediate advantages of this architecture include:

* Using knowledge graph technology rather than conventional databases avoids the cost of redundant data storage as graph nodes can reference data in legacy databases and remote systems, fully respecting privacy and security controls on individual data components. This approach also reduces or eliminates the cost of converting data in the upgrading of a system. Stakeholder acceptance is greater as individual agencies retain full control of their own data.
* The knowledge graph approach is also inherently extensible in that new nodes pointing to new systems can be added all the time. The graph from one jurisdiction can be combined with the graph of another jurisdiction or be rolled up to a higher entity, fostering information sharing or improved collaboration.
* The NIEMOpen-defined justice knowledge graph can also be easily joined with knowledge graphs from other domains such as health and human services, housing, etc., to inform cross-domain justice programs. With the entity-resolved knowledge graph, the entity resolution capability sits at the center and connects person identities across domains.
* This architecture approach makes the use of AI trustworthy. Because the design of the knowledge graph is constrained by the use of the NIEMOpen standards, AI is trained to navigate the Knowledge Graph and follow the NIEM taxonomy, which allows it to operate autonomously within the boundaries of the source data, to answer user inquiries, summarize data, identify gaps and improvements, etc.
* The design of this platform reduces maintenance costs through the use of mainstream, mostly open-source technologies with widespread developer ecosystems. The selected platform supports Java, .NET, and Python programming frameworks, thereby allowing the agency to transition its current IT workforce onto the platform instead of necessitating new recruitment.

Beyond these IT advantages, justice leaders appreciate the broader value premise of this advanced information system architecture. The operational impact of implementing such an enterprise solution for justice will result in:

* + Reliable, accurate, real-time matching of data records by name from multiple contributing systems
  + The capability to discover insights into relationships between people, events and processes of justice
  + Ways to discover gaps in evidence or logic supporting charges and decision-making
  + A common, understandable vocabulary of terms across agencies that will improve collaboration
  + Consistent and extensive security and privacy protections
  + Significant cost reduction and sustainability through eliminating redundant data entry and update habits, with fewer staffing requirements
  + Support for data-informed decision-making and shorter timelines throughout the administration of justice

**Conclusion**

As counties find their older concepts and architectures too costly to maintain or too rigid to produce the outcomes that agencies desire, this general approach will revolutionize the ideal justice information system and fulfill the vision of those who want to improve the operation of the justice system through the availability of quality data to support decision making and reimagining justice.

About the author:

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1. https://www.urban.org/policy-centers/cross-center-initiatives/state-and-local-finance-initiative/state-and-local-backgrounders/criminal-justice-police-corrections-courts-expenditures [↑](#footnote-ref-1)