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R E P O R T

The Universal Core Information Exchange Framework

Assessing Its Implications for Acquisition Programs

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Summary

UCore 2.0 is an Extensible Markup Language (XML) schema designed for transmitting situational awareness data, which is applicable to a very broad range of data types. DoD, the Department of Justice (DoJ), the Department of Homeland Security (DHS), and the Office of the Director of National Intelligence (ODNI) jointly developed UCore to improve interoperability within and between U.S. government agencies.

UCore Has Promise

On the surface, UCore is simply another XML-based data standard available to the DoD acquisition community for establishing interoperability between DoD information systems. However, the data-standard “wrapping” and extensibility capabilities inherent in UCore give it the potential to significantly improve interoperability between DoD information systems and provide a new way to realize the promise of the DoD data strategy. In addition, UCore has the backing and development resources made available by a high-level design consensus between DoD, DHS, DoJ, and the Intelligence Community (IC).

An important aspect of the DoD data strategy is understandability, which requires both semantic and syntactic elements to achieve a working data model. Widespread adoption of a small set of common syntactic or XML standards, such as UCore, will improve understandability, especially for the unanticipated user. However, UCore is not a complete data model and by itself will not meet the interoperability needs of the Navy or the broader DoD. Extensions to UCore, such as Command and Control Core, are needed to make the schema more useful for Navy and other DoD users. The extensibility of UCore makes this increased usefulness possible.

Recognizing the potential benefits of UCore for DoD interoperability, the DoD Chief Information Officer (CIO) is advocating for accelerated adoption of UCore by acquisition programs through policy directives, instructions, and memoranda.

UCore Policy Is Immature

Most existing DoD policy relevant to the DoD data strategy does not mention UCore, and new DoD policy (especially Chairman of the Joint Chiefs of Staff Instruction 6212.01E) provides ambiguous and confusing guidance on UCore implementation requirements. Establishing a clear-cut DoD policy on UCore is complicated by the fact that UCore is neither a simple XML standard nor a complete data model that can meet all of DoD’s interoperability

requirements. Since UCore fits neither paradigm completely, stakeholders in UCore policy are likely to interpret UCore differently—as a standard or a data model or something in between. This creates policy challenges, since the authority to generate policy and guidance on UCore depends on how UCore is defined.¹

UCore Pilot Projects

Alpha and beta testing of UCore 2.0 is complete, and UCore 2.0 was released for use in March 2009. Although UCore 2.0 demonstrates technical innovation and great potential for improving DoD interoperability, especially for the unanticipated user, there is little programmatic guidance for implementing UCore, and there are effectively no hard data on UCore bandwidth demands or cost implications. Bandwidth concerns are potentially significant because metadata tagging can increase message size and associated bandwidth requirements by more than an order of magnitude. Although such an increase in bandwidth demand may not be an issue in the high-capacity networks of the Global Information Grid, it could be problematic for low-bandwidth tactical-edge wireless networks.

At most, five of the 19 documented pilot projects assessed UCore performance in tests that actually used a DoD network. Two pilot projects appear to have been tested on a local area network, another two appear to have been tested on the Defense Information System Network, and one was tested on an unspecified network. None appear to have been tested on a tactical network.

These UCore pilot projects are not well documented, and there is not sufficient technical information to help acquisition program managers make informed UCore implementation decisions. Furthermore, detailed technical data on UCore implementation options, including information on UCore message sizes, are not readily available, even for only the minimal implementation of UCore. Therefore, this body of evidence cannot be used to assess the impact of UCore on Navy networks or to assert that UCore can be implemented effectively and without risk on Navy networks with bandwidth limitations.

UCore Implementation Options and Risks

There are several ways to implement UCore. Some of these implementation options are feasible only if extensions to UCore are available. Others can be implemented more quickly if existing XML schema are wrapped in UCore. Limited guidance and supporting technical information that describe the potential advantages and disadvantages of these implementation options, their costs, and their impact on the Navy networks are available.

The limited data on UCore message sizes and cost implications should be a source of concern in the DoD acquisition community, especially in light of UCore's flexibility and the variety of implementation methods available, both of which greatly complicate the technical and cost assessment of UCore systems.

XML messaging is typically verbose, and UCore is no exception. Additionally, the extensibility and wrapping inherent in UCore messages make the assessment of network impact

¹ For an in-depth exploration of information technology roles and responsibilities in the DoD, see Gonzales et al., 2010b.

even more difficult because there is significant potential variability in UCore message sizes. Finally, the cost of implementing UCore will vary greatly depending on specific implementation choices. These technical issues need to be understood and addressed before UCore implementation can be mandated.

Recommendations

In light of these findings, we make the following recommendations:

- The Navy should not require widespread UCore implementation at this time.
- DoD should undertake additional UCore piloting efforts to quantify potential system and program impacts. It should
 - Capture UCore vocabulary size, message sizes, system processing speeds, and network bandwidth consumption.
 - Model and document program UCore implementation costs for specific UCore implementation options.
- Any future UCore requirements or mandates should not originate ab initio from policy but should rather be informed first by the evaluation of technical and cost data from well-documented future pilot projects.
- Guidance for setting UCore requirements in program Initial Capabilities Documents should include an analysis of alternatives that weighs interoperability benefits against bandwidth impact. For example, systems that will regularly interact with DoJ DHS/IC systems clearly need to implement UCore or an equivalent, but tactical-edge systems with limited bandwidth might be forbidden to use UCore, and headquarters intelligence databases attached to wideband networks that accumulate data from the tactical edge might be allowed to generate UCore messages for passing information up the chain of command on high-bandwidth networks.
- The Navy should permit UCore implementation if (1) the program depends only on high-bandwidth networks or (2) UCore will not degrade or otherwise affect required real-time performance requirements for the system or system of systems to which the subject system belongs.
- The Navy should develop guidance for preferred UCore implementation approaches that accounts for different Navy networks and operational environments.
- DoD should develop a new, streamlined version of Ucore (UCore 3.0) that contains a small and extensible core vocabulary for the UCore core primitive data frameworks for “who” and “what.”

Future Work

Related RAND Corporation research for the Director of Joint Interoperability, Under Secretary of Defense for Acquisition, Technology and Logistics, has shown that XML compression can greatly reduce the size of XML-tagged messages. This may enable UCore messaging to be used on networks that have bandwidth limitations. Further research is required both to deter-

mine how effective XML compression is when applied to UCore messaging and to determine which Navy network types could support compressed UCore messaging.

One of the greatest long-term potential benefits of UCore adoption will be the ability of different communities of interest to independently develop improved data tagging using UCore or a UCore extension *while remaining interoperable* (to a certain degree). However, to realize that capability, the UCore data model needs to avoid becoming a centrally managed affair—a situation that could inhibit innovation (as has occurred in the case of the National Information Exchange Model). DoD and the Navy should develop alternative ways of managing the UCore data model that encourage program experimentation while ensuring that bandwidth issues and implementation costs are addressed.