

Employing MOSA in DoD Programs: *Implications for Real-Time Operating Systems*

In February of 2025, the Office of the Under Secretary of Defense for Research and Engineering published a guidebook for the Department of Defense community. The goal of this document is to provide “information to help ensure programs incorporate a modular open systems approach (MOSA) as part of the defense acquisition program life cycle.” Entitled “Implementing a Modular Open Systems Approach in Department of Defense Programs,” you can find the complete [guidebook here](#).

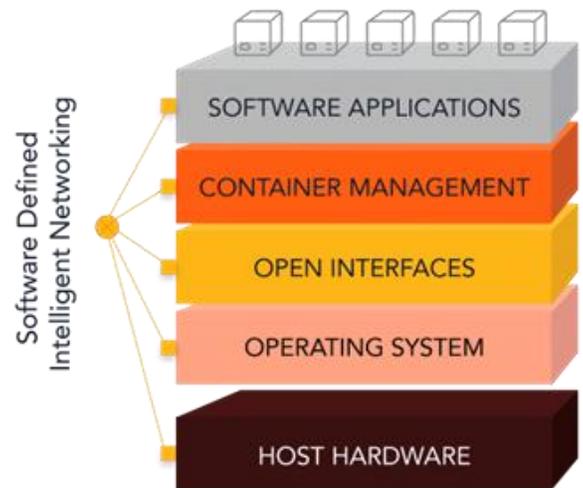
Real-Time Operating Systems (RTOS) play a vital role in the infrastructure of embedded systems. They provide deterministic, low-latency capabilities for data processing, communications, navigation, sensor-weapon control, autonomy and more. A RTOS is also the critical connection between the system hardware and application software. It’s the glue that holds the platform together so that it can perform as required.

There are several areas where a RTOS needs to support MOSA goals. Three of the most important are:

- Modularity to allow reuse and incremental upgrades to both hardware and software
- Abstracting software from hardware for portability
- Managing a wide variety of data I/O to support various sensor configurations

RTOS Modularity that allows reuse and incremental upgrades

Many RTOS solutions compile into a monolithic binary. This is problematic when it comes to updating or changing any one component. For example, if you upgrade a sensor for improved performance, you will have to completely rebuild and re-test the entire monolithic RTOS. With a modular RTOS, you only need to address the single software component needed to support the new sensor. You can reuse most of the executables without re-testing which accelerates upgrades to hardware components. Minimizing changes to the RTOS is the key to driving quicker updates to the warfighter.



Supporting a wide variety of hardware deployments

Software performance is dependent on the hardware. A well-designed RTOS can help abstract both the kernel and application software from individual hardware needs. By employing an abstraction library that is dynamically linked, the RTOS can run on a variety of hardware solutions without the need for modification. This significantly reduces costs through software reuse.

Abstracting I/O to enable rapid sensor upgrades

Across domains and platforms, there is a need for a wide variety of sensors. Applications require data from these sensors and this data can come in an assortment of formats and over different networks. One way a RTOS can handle this variability is by employing user space device drivers and I/O libraries.

Even in a simple upgrade situation, the I/O interface in a given software application can differ significantly from the interface in the prior configuration. Managing this I/O volatility and the resulting software change presents significant challenges to developers and their software teams. A RTOS that uses user space device drivers can add and remove drivers just like any other application and not affect the kernel or any other applications. I/O libraries enable data movement in the system from driver to application without them being tightly coupled. Together these I/O approaches provide modular updates and software portability across platforms.

Summary

When implementing a MOSA architecture, focus on the RTOS component should consider:

- Modularity of software components
- Support of a variety of hardware
- The ability to support a wide variety of sensor input

Deos™ is designed to enhance and enable application software portability, where binary reuse is the ultimate form of portability. Deos was originally developed for use in the aerospace industry where verification and certification costs are notoriously high. The ability to reuse executables and shared libraries without modification on new (compatible) target systems does significantly reduce costs.

You can learn more about the [Deos™ Real-Time Operating System here](#).

References:

1. “Implementing a Modular Open Systems Approach in Department of Defense Programs” can be found at: <https://www.cto.mil/wp-content/uploads/2025/03/MOSA-Implementation-Guidebook-27Feb2025-Cleared.pdf>
2. Deos Real-Time Operating System solution page: <https://www.ddci.com/solutions/products/deos/>