Open Architecture in Electronics Systems

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Open Architecture, 10 years ago

- **Goals of "Open Architecture"**
  - to guarantee the previously-developed military subsystems were usable in platforms under development
  - new subsystems being developed for use in new platforms could be reused in future platforms

- **How is "future platform reuse" supported?**
  - **Maximize use of Industry Standards**
  - **Minimize custom design content of any "Vetronics" item that has a commercial equivalent**

- **How well did this work? See next slide.**

> **Vetronics** is vehicle computer resources,
> vehicle busses, peripheral electronics such as sights,
> human/machine interface boxes, electronic GFE, etc.

Open Architecture, 10 years ago
What is "Open" – What was the Result?

Standard 28 VDC Vehicle Power Source	
Standardized command / response & communication busses, such as MIL-STD-1553B & Ethernet	
Standardized interfaces, such as VGA, RS170	
RS-232, RS422, RS423	
Standard backplane, such as VME	
Use of "Middleware" OE to permit computer HW update	
Standard form factor circuit cards	

Open Architecture, 10 years ago
What is "Open" – What was the Result?

Standard 28 VDC Vehicle Power Source	**Compatible with most GFE**
Standardized command / response & communication busses, such as MIL-STD-1553B & Ethernet	**Electrical compatibility, but must comply with GFE ICD**
Standardized interfaces, such as VGA, RS170	**Electrical and waveform compatibility**
RS-232, RS422, RS423	**Electrical compatibility, but must comply with GFE ICD**
Standard backplane, such as VME	**Basic compatibility, but VME spec. includes a "custom" connector**
Use of "Middleware" OE to permit computer HW update	**No Application impact when obsolescence redesign(s) introduced**
Standard form factor circuit cards	**No benefit. Function density, environmentals, and "custom" connector required custom CCAs.**

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- Open architecture **is a type of <u>computer architecture</u> or <u>software architecture</u> that allows adding, upgrading and swapping components. For example, the <u>IBM PC</u> has an open architecture, whereas the <u>Amiga 500</u> home computer had a** closed architecture**, where the hardware manufacturer chooses the components, and they are not generally upgradable.**

- **(Deleted definition that relates to Architectural Design of Buildings)**

- **Open architecture allows potential users to see inside all or parts of the architecture without any proprietary constraints. Typically, an open architecture publishes all or parts of its architecture that the developer or integrator wants to share. The open business processes involved with an open architecture may require some license agreements between entities sharing the architecture information.**

21 Oct 2008 Wikipedia Definition, parsed

- Characteristics of Open architecture
  - **allows adding, upgrading and swapping components**
    - **For example, the IBM PC has an open architecture, whereas the Amiga 500 home computer had a** closed architecture**, where the hardware manufacturer chooses the components, and they are not generally upgradable.**
  - **allows potential users to see inside all or parts of the architecture without any proprietary constraints**
    - **Typically, an open architecture publishes all or parts of its architecture that the developer or integrator wants to share. The open business processes involved with an open architecture may require some license agreements between entities sharing the architecture information.**

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Wikipedia	Possible Manifestation in Vehicle Design	How does Vehicle Design Enable?
Allows adding, upgrading and swapping components	Uses standard power levels	Meet Military standard vehicle and industry standard backplane bus voltage levels
	Uses standard form factor and connectors	Select and implement commercial standard card and connector specifications
	Meets environmentals	Provide an environment that adapts vehicle environmentals to commercial specifications
	Uses standard communication busses	Use popular commercial busses
	Follows communications standards	Use accepted protocols for communication busses
	Comes with drivers that bridge component to OS	Software architecture contains a "driver" layer, and implements appropriate standards
	Software runtime is compatible with OS	Use an Operating Environment "Middleware" to isolate applications from OS
	Firewalls for hard real time applications	Architecture to include resource management to assure resource starvation doesn't occur

Building on the Wikipedia 21 Oct 2008 Definition (2 of 2)

Wikipedia	Possible Manifestation in Vehicle Design	How does Vehicle Design Enable?
allows potential users to see inside all or parts of the architecture without any proprietary constraints	Documentation partitioned to describe services, communication & task management interfaces of core and upgradeable capabilities; no documentation of sensitive capabilities	Assure appropriate development documents are suitable for public release

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Goals of Today's Open Architecture Definition for Military Vehicles	Possible Manifestation in Vehicle Design	How does Vehicle Design Enable?
Avoid developing unique designs and proprietary solutions when industry accepted standards exist	Use industry accepted standards, covered earlier	Covered earlier
Enable use of commercial hardware and software solutions, when suitable	Use commercial hardware	Adapt between vehicle and commercial environmentals. Covered earlier
	Use commercial software	Provide middleware or Operating Environment to isolate OS from commercial SW. Covered earlier
		Possibly modify design of commercial software
Maximize upgradeability with commercial hardware and software solutions, when suitable	Covered above	Covered Above

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Goals of Today's Open Architecture Definition for Military Vehicles	Possible Manifestation in Vehicle Design	How does Vehicle Design Enable?
Support not-well-defined or constrained increases in platform computer resource needs.	Include reserve space for additional hardware	Leave room for new chassis or empty slots in existing chassis
	Include space for additional memory capacity	
	Include reserve electrical power to run that hardware	Add reserve to power budget
	Include present and future voltage levels to power that hardware	Provide traces to empty slots for possible future power supply CCAs
	Include space and data bus allocations for user interface escalation	Provide connector reserve capacity or extra unused connectors

Mapping of Prior Definitions to U.S. Navy Open Architecture Definition

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LynuxWorksTM Website Definition of U.S. Navy Open Arch.	Covered Earlier?	How does Vehicle Design Enable?
Modular design and design disclosure	Yes	
Reusable application software	No	Requires application software works with standard or disclosed APIs, system unique parameters must be loaded at runtime
Interoperable joint warfighting applications and secure information exchange	Not covered, per se	Provide computer resources and APIs for applications and a certified architecture for secure info. exchange
Life-cycle affordability	Not articulated	Meet all aforementioned requirements
Encouraging competition and collaboration through development of alternative solutions and sources		