

Computing Technology using Mainstream COTS for Naval Combat Management System

2015. 3. 13.

LIG Nex1 / Combat System R&D Lab
YURA LEE

Short Summary

✓ Hardware

- Custom built computers from the defense market dominant large corporation.
- Highly rugged computing units
- Specific-structured systems
- Yesterday's technology

✓ Software

- System designed with closed architecture and interface
- Monolithic applications
- Specific languages
- Tight coupling with specific hardware

※Reference: U.S. Navy, Program Executive Office for Integrated Warfare Systems,
<http://www.cwhonors.org/viewCaseStudy.asp?NominationID=205>

As Is

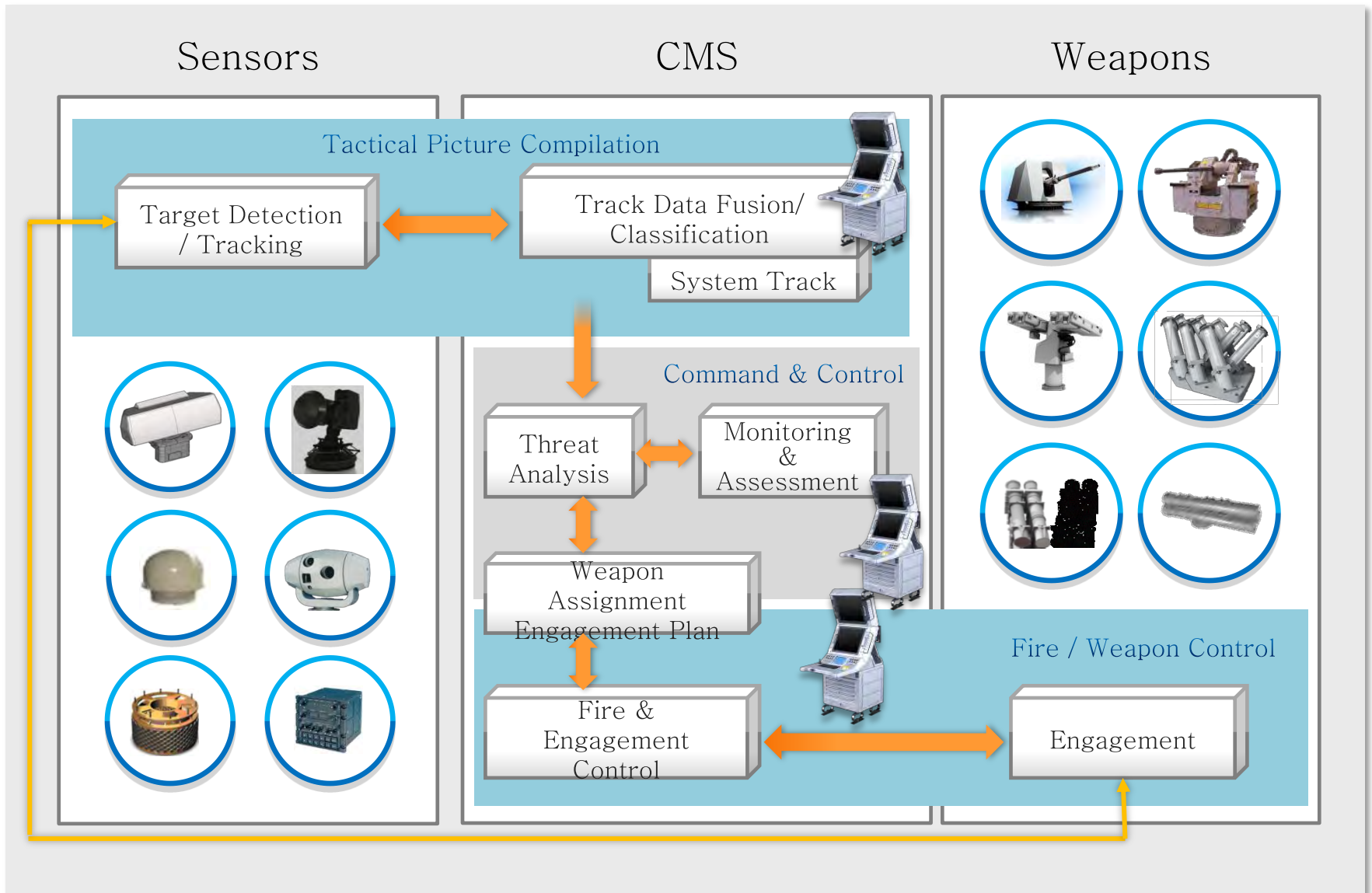
- Monolithic systems that meet the need for the security and military operating environment.
- Designed with closed architecture and MIL spec hardware components.
- Designed to combat a known threat, and not as effective in combating the smaller, distributed enemies in the new global environment.
- Made up of custom built computers from the defense market dominant large corporations

To Be

- Rapid technology insertion of new technologies and the enabler of competition for system and sub-system upgrades
- Rapid deliveries and update driven by widely proven commercial products
- the opportunity accruing from subcontractors and small businesses when trying to enter the defense market

※Reference: U.S. Navy, Program Executive Office for Integrated Warfare Systems,
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Combat Management System(CMS)



If (CMS == Floating Data Center)

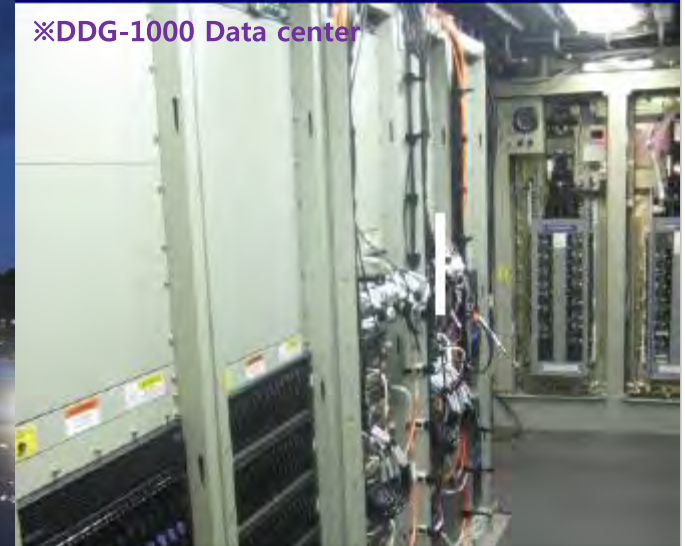
“The USS Zumwalt will be a **Floating Data Center**”

※Reference: [Article]“The Navy’s newest warship is powered by Linux”, ars technica, by Sean Gallagher, Oct 19 2013



Inside view of Computing Data Center with COTS IBM Blade Servers

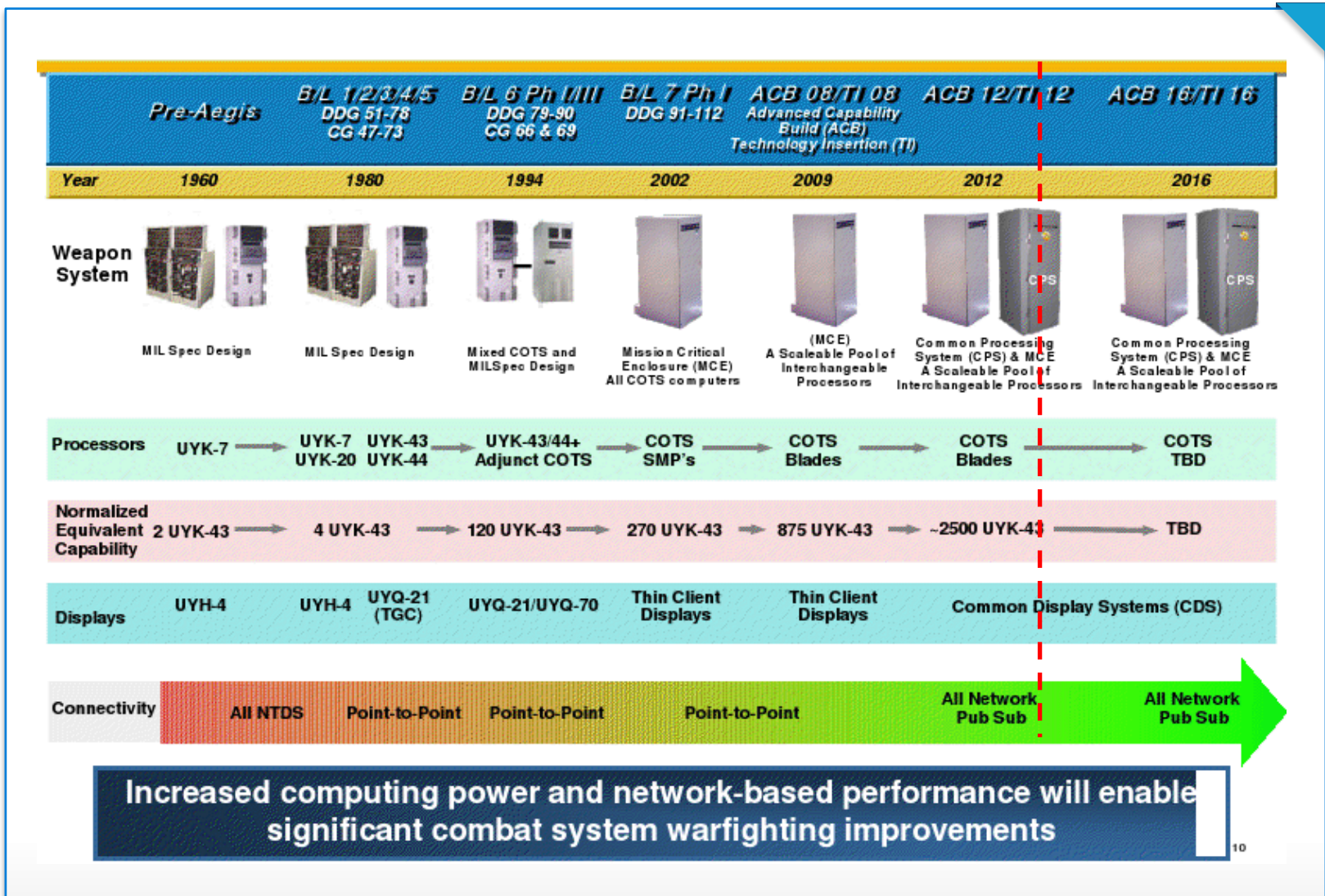
※DDG-1000 Data center



Floating Data Center

It is a term used to describe the Google’s floating ‘Data Center’ embarked on a barge. ‘Data Center’ refers to a massive infrastructure equipped with computer systems, communication equipments, and data storages to provide service/storage for big data. The identical term ‘Data Center’ is also used for DDG-1000(Zumwalt) since its combat system is Data Centerized and installed on a floating combat ship

Evolution in Computing Technology of Aegis



※ UYK-43 : 32bit/6VME(~'84)

Why Mainstream COTS?

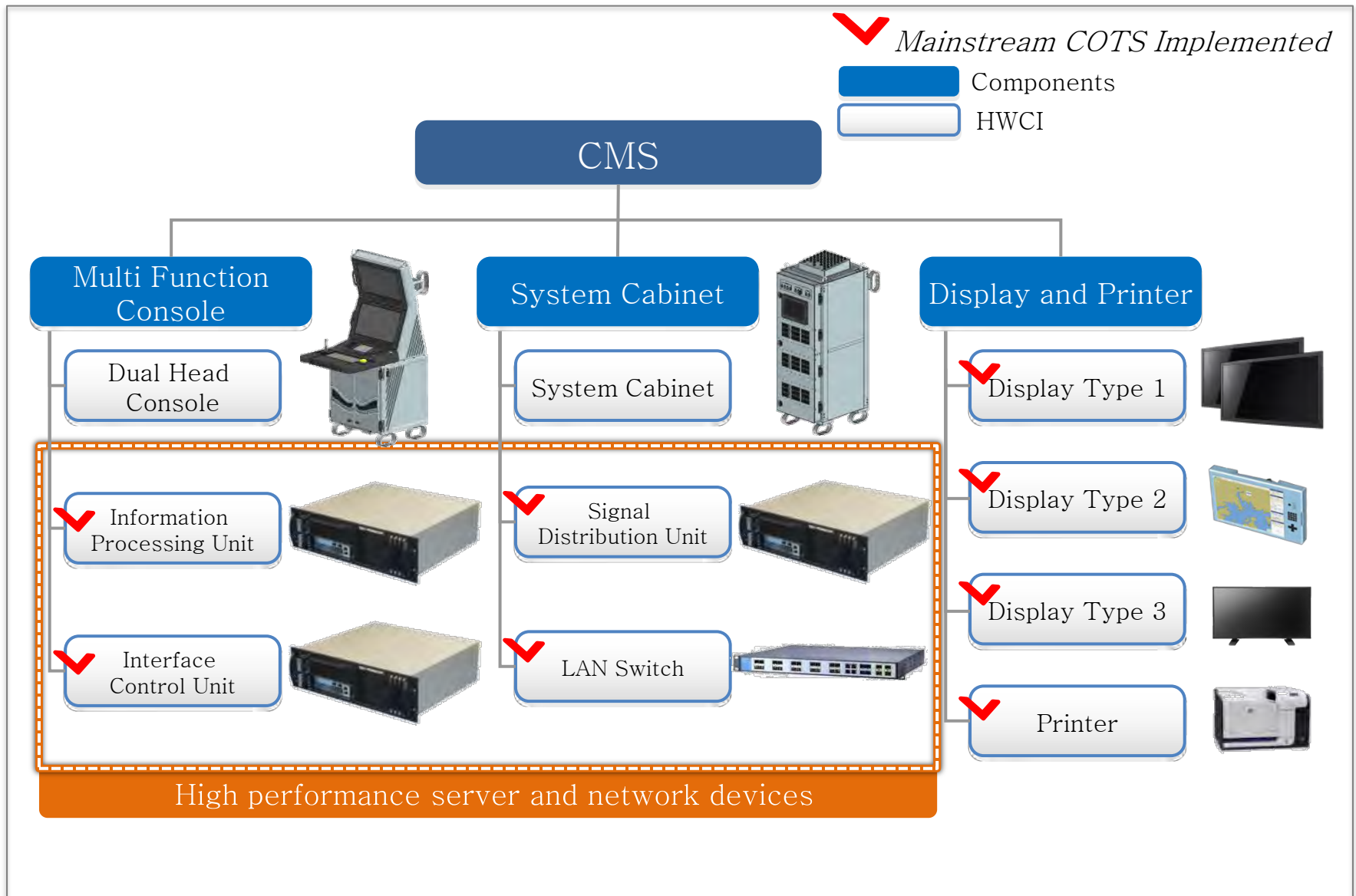
Mainstream COTS

Mainstream COTS refers to a COTS product which is aligned with mainstream technology of predominant product available in the commercial market.

As technology advances, relevant upgrade/modification for the used (Mainstream) COTS will also be made available.

- Reduced risk of becoming obsolete
 - Widely accepted commercial standards with Proven quality and reliability
 - Applying COTS component, tools, and best practices aligned with mainstream technology
- Simplified Maintenance and Upgrades
 - Reduced cost for COTS replacement
 - Mutually independent software/hardware upgrades
 - System expandability not hampered by hardware resources
- Reduced cost for system acquisition and maintenance
 - Minimize required hardware/software R&D for combat system
 - Re-usable software for various other system
 - Reduced cost for utilities including spacing and electrical power
- Efficient Testing and Evaluation
 - Already proven in the commercial market → Simplified testing/evaluation procedures

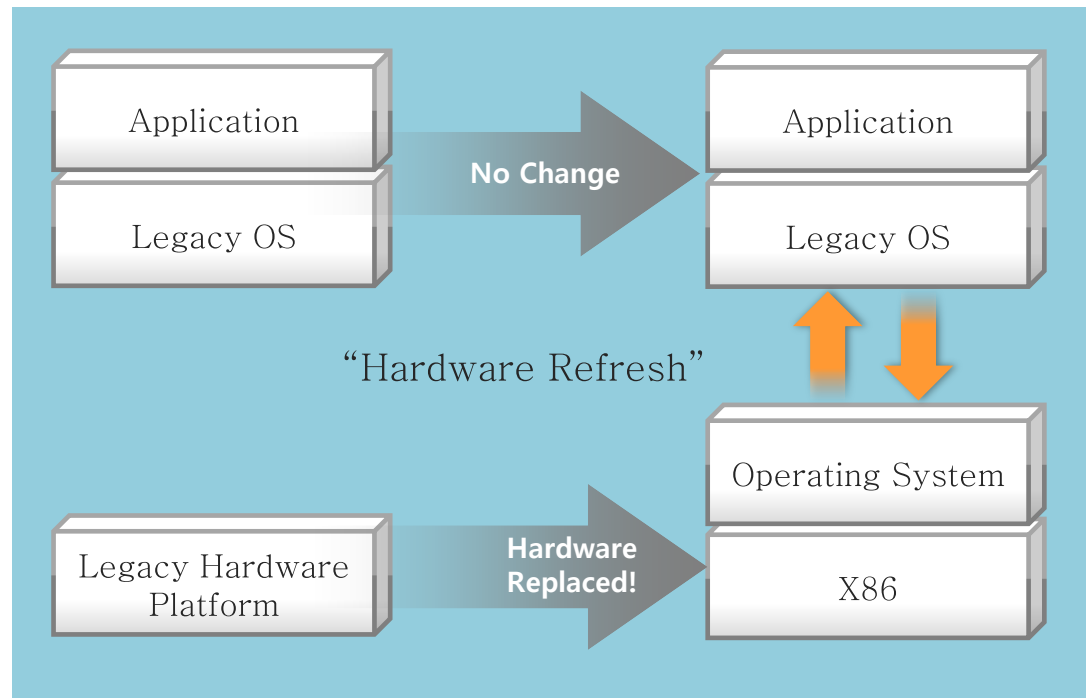
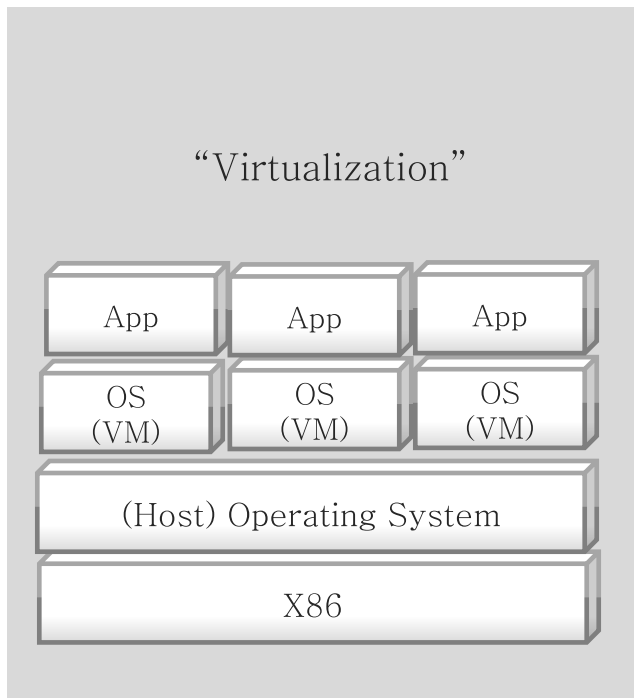
General-purpose Computing System



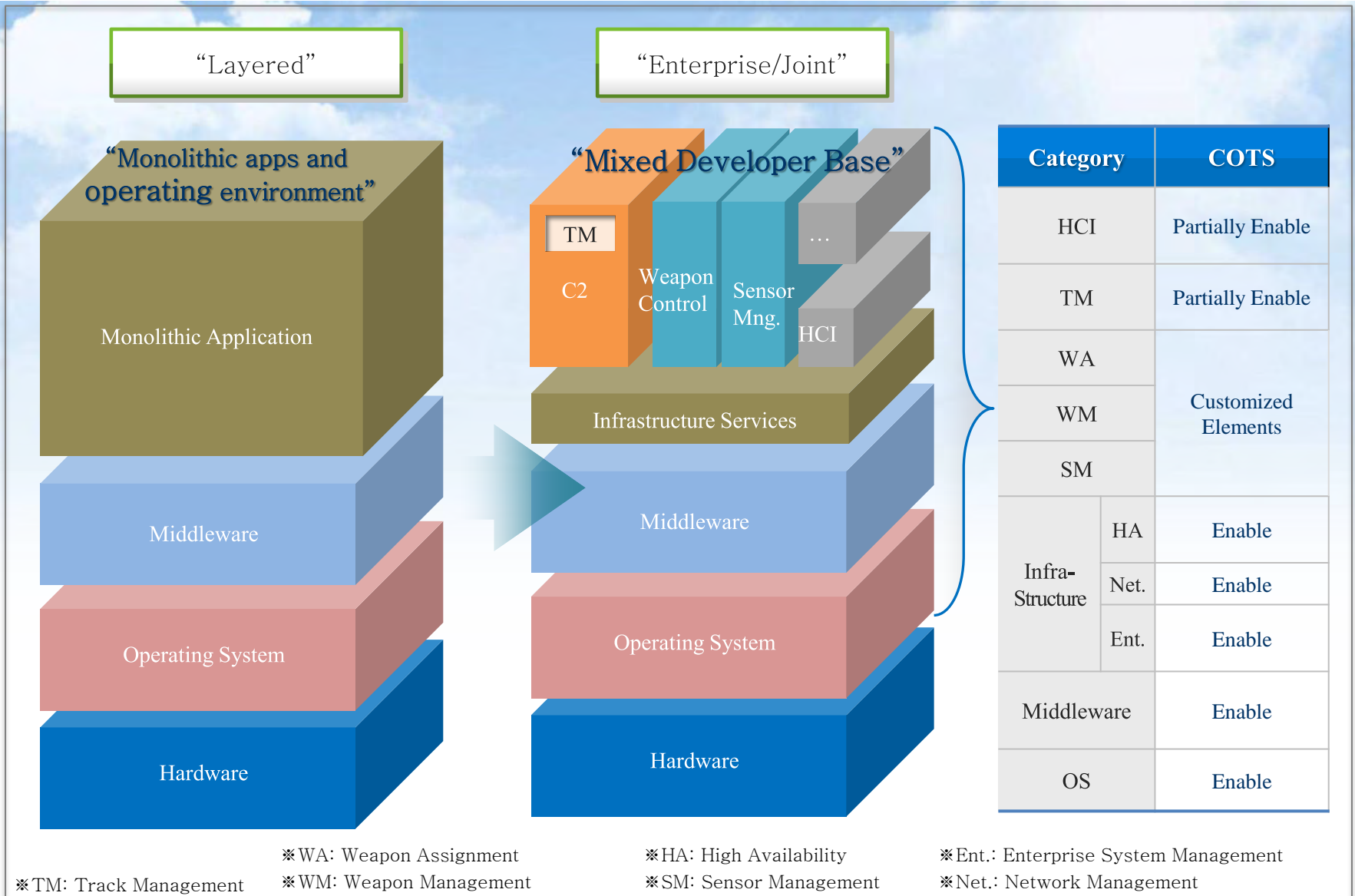
Decouple Hardware and Software via virtualization

Virtualization

‘The virtualization’ seems to be a suitable solution to provide software isolation and remove application compatibility issues. This technology provides a framework that enables many of virtual machine commonly referred to as the ‘Guest Operating System’ across far fewer physical computing systems.



Reduce Development with COTS insertion



COTS Insertion-Enterprise system Management

- Figure out real-time system status and fault
- Long-term analysis for the system

※ EM: Enterprise System Management



Item	Function	Graphing																									
CPU	CPU Usage, User, Wait, Idle, etc	<p>Server: vista 192.168.128.23</p> <table><thead><tr><th>Source</th><th>Target</th><th>QoS</th><th>Max</th><th>Avg</th></tr></thead><tbody><tr><td>Vista</td><td>Vista</td><td>QOS_CPU_USAGE</td><td>70.29</td><td>12.45</td></tr><tr><td>Vista</td><td>C:\</td><td>QOS_DISK_USAGE_PERC</td><td>76.09</td><td>75.06</td></tr><tr><td>Vista</td><td>Vista</td><td>QOS_MEMORY_SWAP_PERC</td><td>86.25</td><td>85.82</td></tr><tr><td>Vista</td><td>Vista</td><td>QOS_MEMORY_USAGE_PERC</td><td>64.62</td><td>46.92</td></tr></tbody></table> <p>% CPU/Memory/Disk/Swap</p>	Source	Target	QoS	Max	Avg	Vista	Vista	QOS_CPU_USAGE	70.29	12.45	Vista	C:\	QOS_DISK_USAGE_PERC	76.09	75.06	Vista	Vista	QOS_MEMORY_SWAP_PERC	86.25	85.82	Vista	Vista	QOS_MEMORY_USAGE_PERC	64.62	46.92
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Disk	Disk Usage, Availability, etc																										
Memory	Memory Usage, Paging, Swapping, etc																										
VM	CPU/Memory/Disk status for VM																										
Network	Traffic, Packets, Operating state, etc																										
Etc.	Status of Console, System Cabinet, UPS, Panel PC, fan cooler unit																										

※ Reference : <http://www.ca.com/>

COTS Insertion – MODBMS for TM

- High performance spatial-data processing using In-Memory DBMS
- Technology used in Navigation market



Kairos

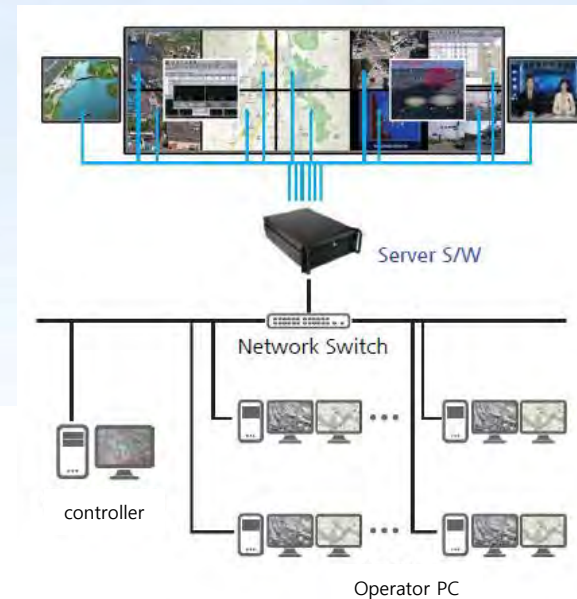
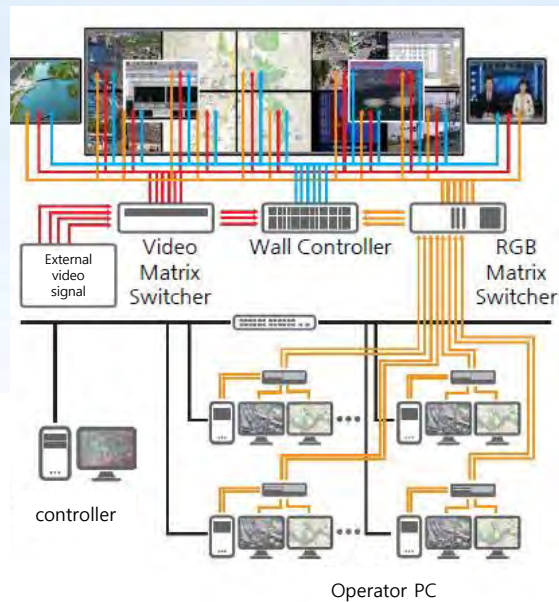
Examples

※ MO: Moving Object

Item	functions	Examples of operators		
TM (Track Management)	Track correlation, association.. etc.	Operator	Explanation	Graphing
		ST_DISTANCE	Distance between two moving objects	
		ST_DISTANCE	Projection of 2-D to X /Y axis	
	
Navigation Support	Navigation Plan Management	Operator	Explanation	Graphing
		Relational Operators	Decision of phase relationship between two objects – figure out adjacent objects – decision for cross paths	
	

COTS Insertion – Real time Video Distribution

- Real time video distribution via network (Mirror to Mirror 0.03s)
- Addition to In/Out Display without building additional HW or Cable
- UHD resolution (Maximum resolution of Video Matrix: FHD)
- No distance constraints
- Add-ons for Mobile(WiFi/3G/LTE) and Web display



User eXperience –UI(User Interface)



Recommend
Improvement

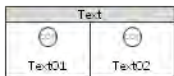
Analysis functions of
similar systems

Work out a plan UI
Commonization

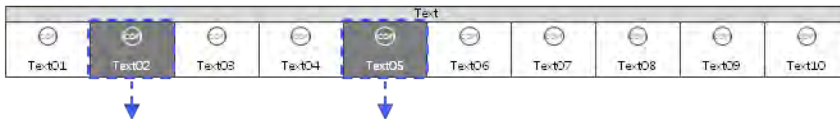
Design Keyscreen
/basic flow

Examples

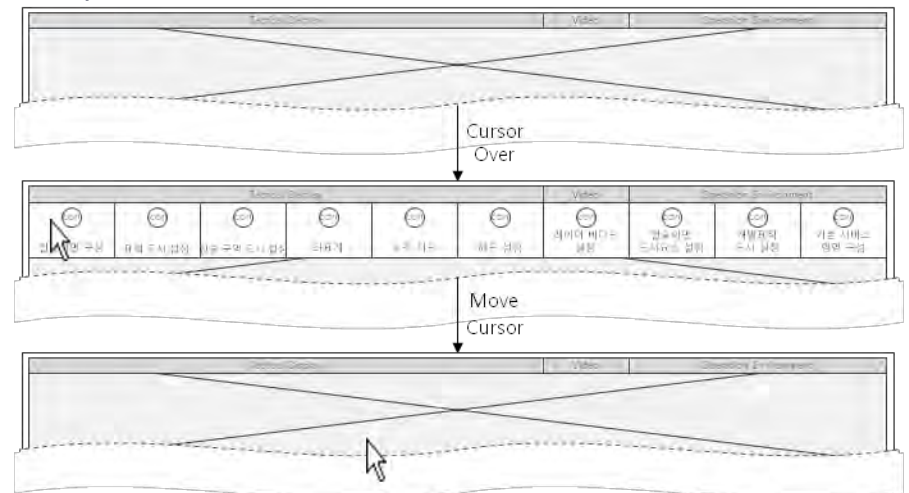
[Menu bar 2]



[Menu bar 10]



[Examples]



User eXperience –GUI(Graphic User Interface)



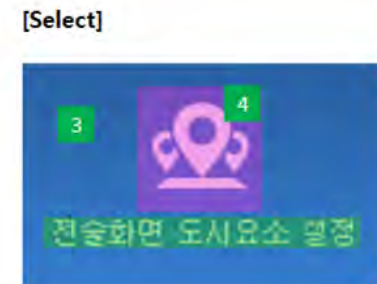
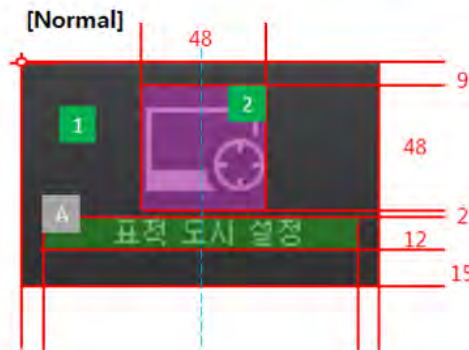
Analysis User Environment
and Benchmarking
/Design Trend

Draw Keyword and
Strategy of Design

Draw and Propose
Design Concept

Develop GUI Design
/Guideline

Examples



Use Open Standards and published Interfaces

Interface standards should be derived from widely available, widely adopted commercial standards

- Open Standard

PCI, TCP/IP, UDP, GigE, H.264, JPG, OMG DDS, SNMP, C#, C++ , ...

- Etc.

ALMAS(Alert Management Service) Standard

AMSM(Application Management and System Monitoring) Standard

OARIS(Open Architecture Radar Interface Standard)

Conclusions

- It provides advanced processing power for applications of the combat management system, because rapid evolution of COTS technology
- It reduces system cost by using COTS rather than built product
- It provides rapid deliveries and update driven by widely proven commercial products
- It reduces the risk of becoming obstacle, because of Widely accepted commercial standards with Proven quality and reliability
- It enables other companies—both large and small—to provide competitive solutions for maintaining, upgrading, or extending systems



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