THALES

TACTICOS Combat Management System
Exploiting the Full DDS Potential

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DDS Information Day - DC

Content

- DDS as an enabler for the success of the TACTICOS Combat Management System (CMS)

- Combat Management System
- TACTICOS CMS
- Architectural principles
- Role of the DDS
- Information centric approach

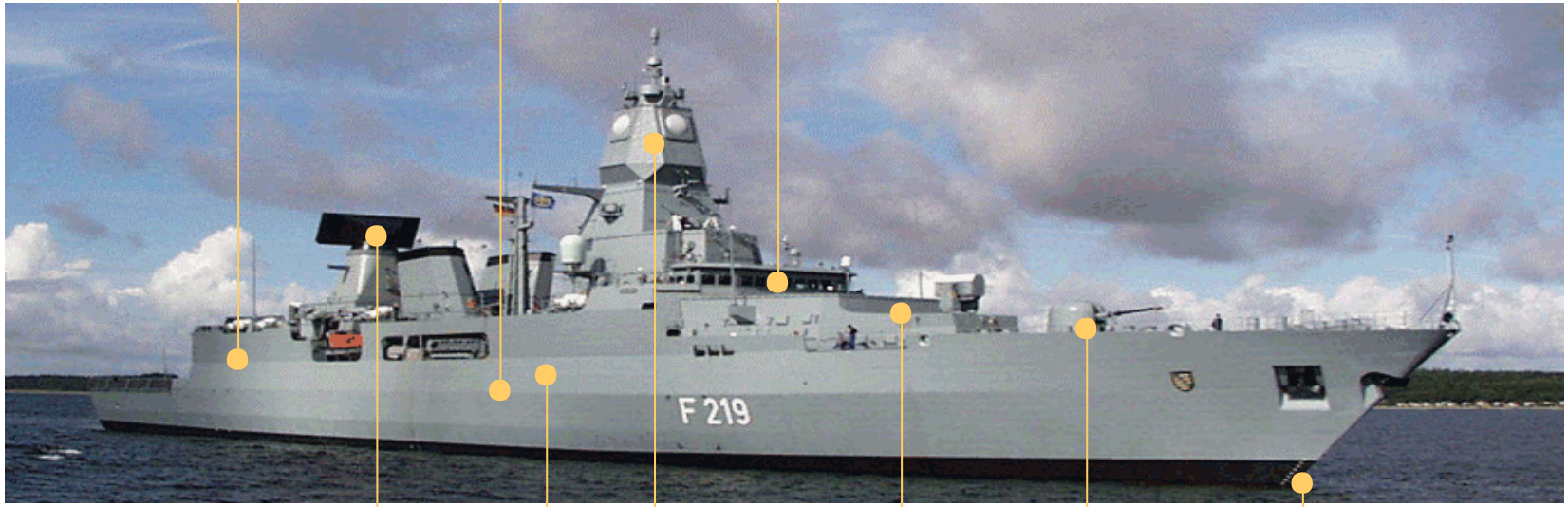
CMS

Above Water Systems

Platform Management System

Communication System

Navigation System



3D Radar

Combat Management System

Multi Function Radar

Missiles

Gun

Sonar

Combat Management System (CMS)

THALES

OPERATIONAL REQUIREMENTS

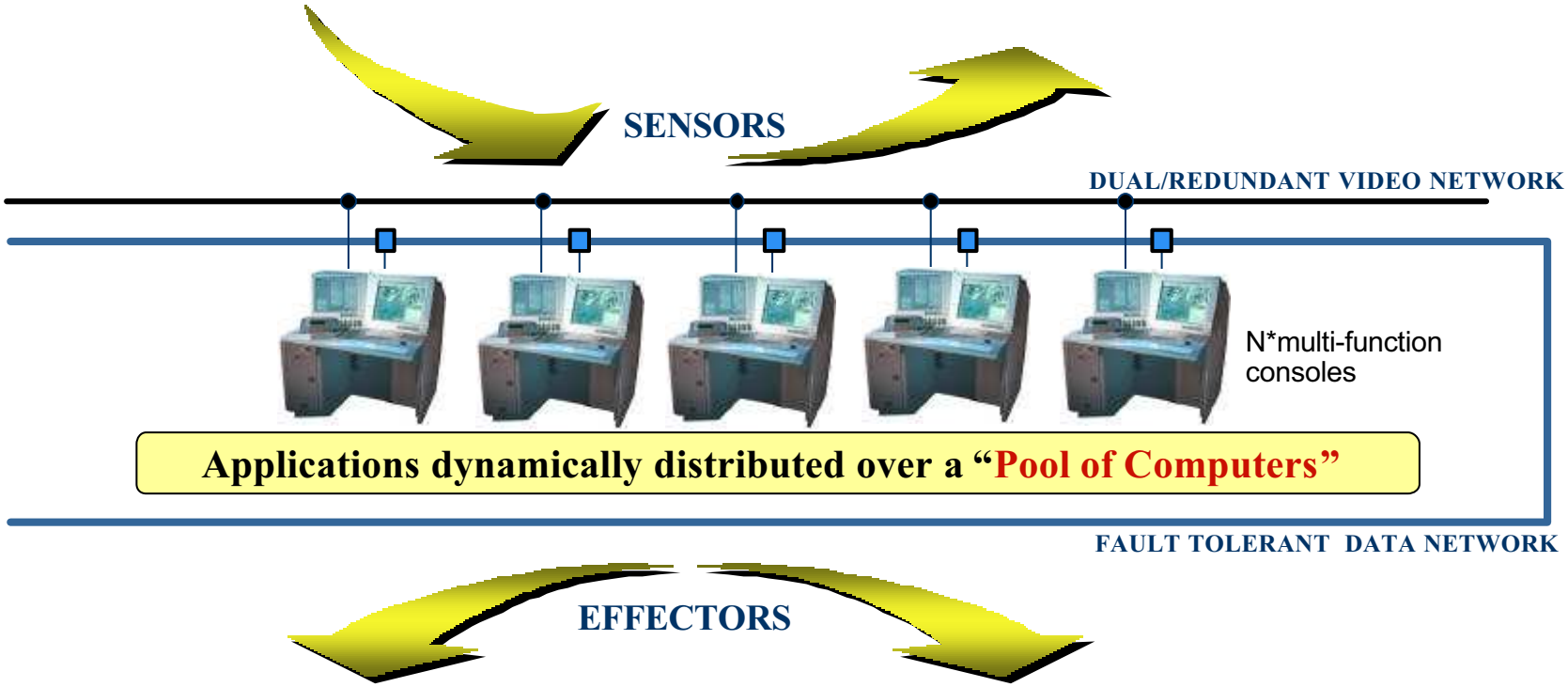
- Vast amounts of information
- Thousands of tracks
- High degree of automation
- Automatic multi- sensor data fusion
- Automatic threat evaluation
- Automatic sensor + weapon pairing
- Extensive Command Support
- Easy to Operate
- Easy to Maintain
- Flexible in Missions, and Manning
- On-board Training & Simulation
- Total System Integration

TACTICOS CMS

Field proven architecture

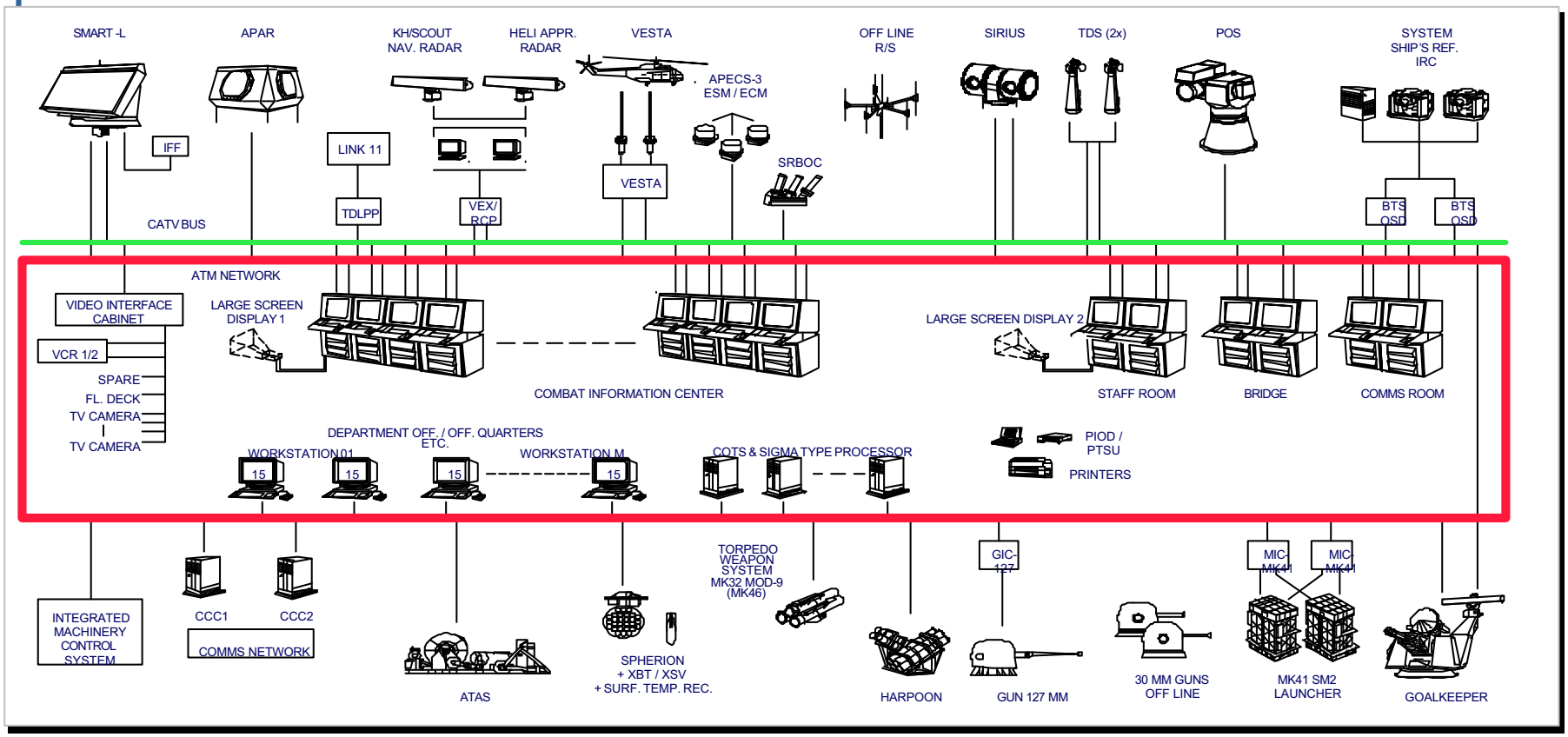
- In service since 1993
- Used by 15 navies world wide
- 22 Ships classes from patrol boats to destroyers

TACTICOS Architecture Concepts



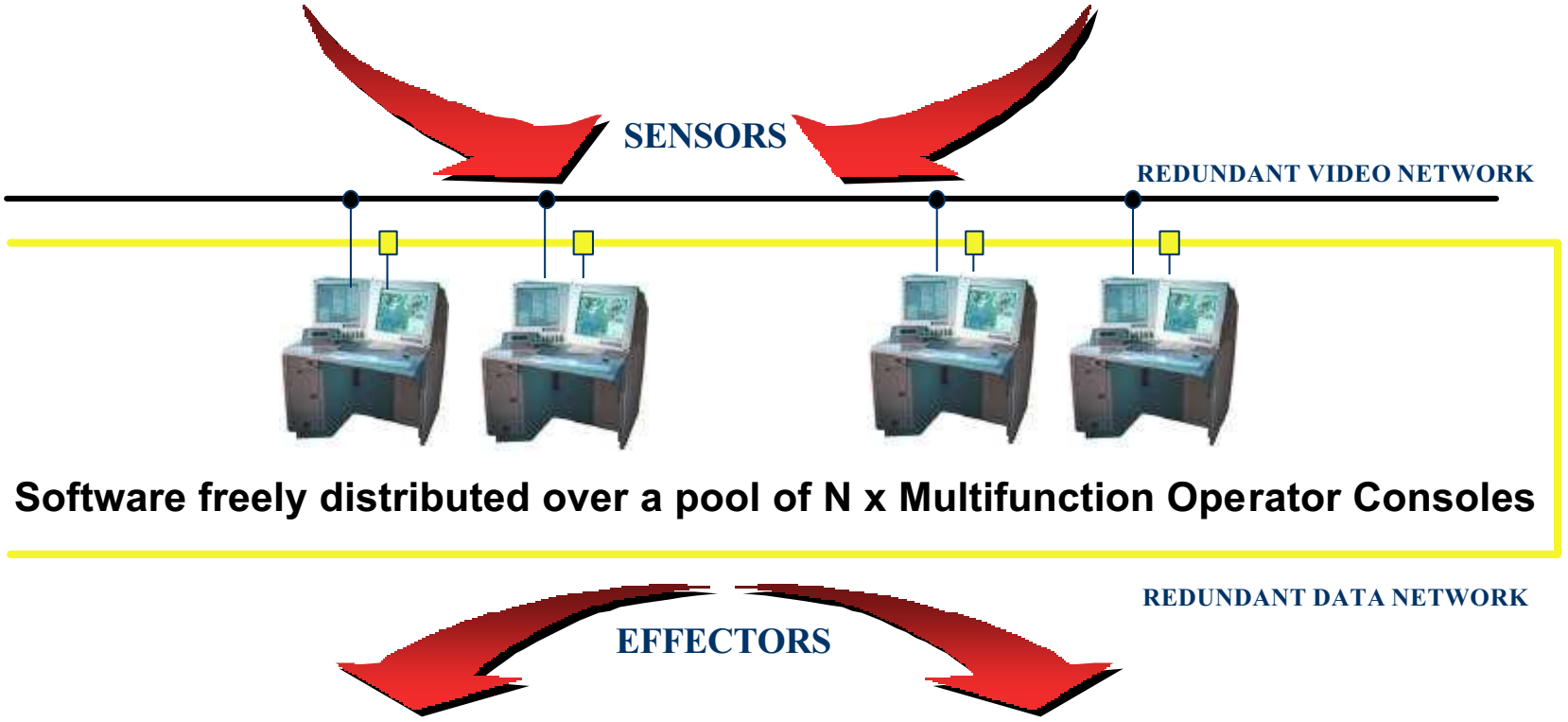
Fault-tolerant:	*High combat survivability & maintainability (no single-point-of-failure)*
Flexible:	*Mission-based configuration, on-board training & simulation*
Evolvable:	*Evolutionary upgrading based on COTS & Open Standards*
Scalable:	*From patrol-boats up to destroyers*

Fully Distributed Architecture



- **Distributed Processing**
- **Distributed Sensor & Weapon Interfaces**
- **Distributed Sensor – Weapon Deployment**

Fully Distributed Processing

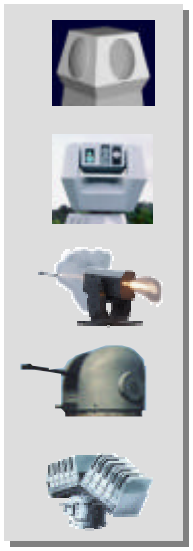


- No single point of failure
- N - fold redundancy
- High combat survivability

3 Tier Architecture

Sensors & Actuators

RT



Data

Business Logic

nRT

Dependability

High availability

- Correlation
- Fusion
- Hypothesis testing

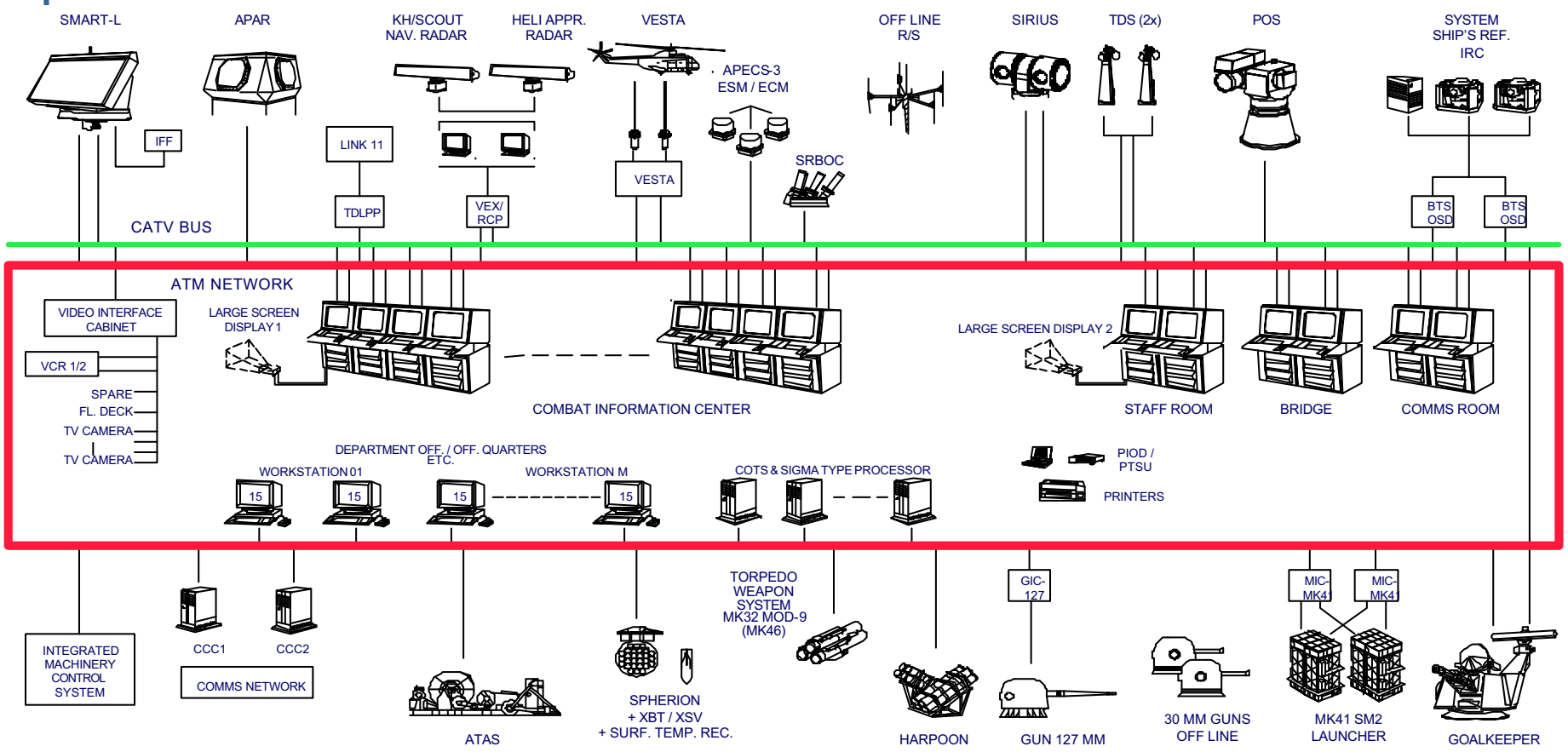
Information

User Interface

Platform independency

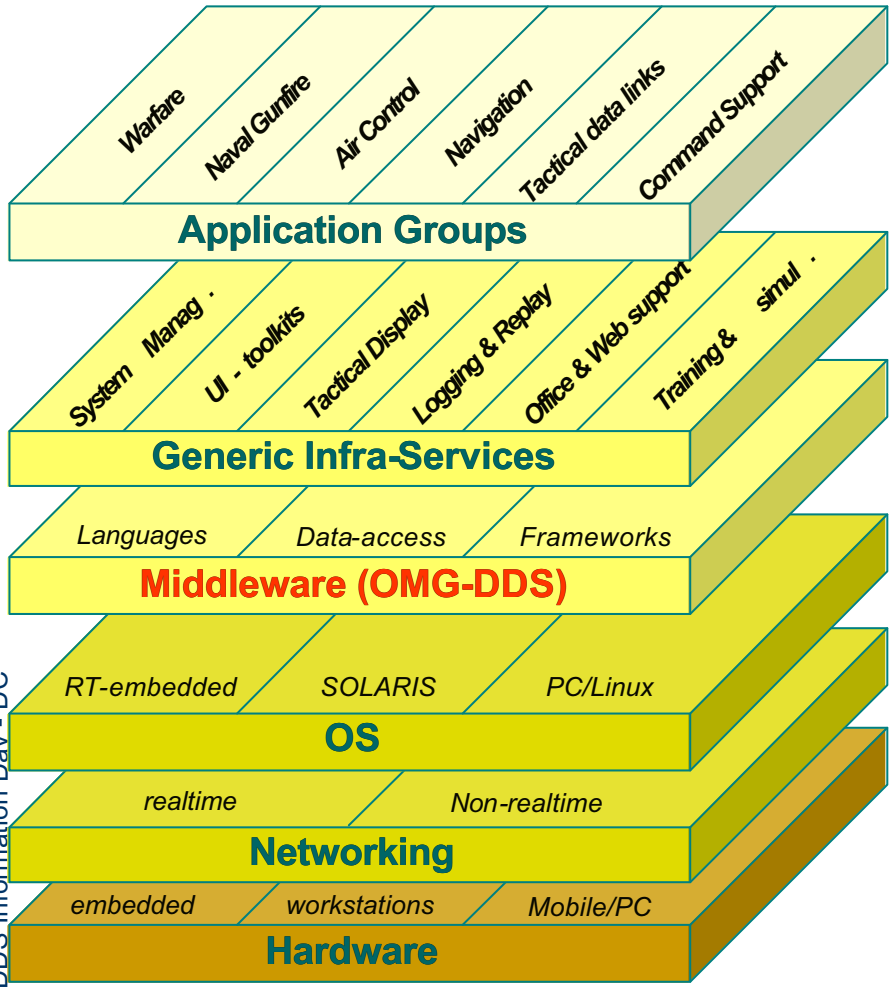
DDS Information Backbone

Metrics Overview



Data-traffic:	***4.000 publications per second over the system-data bus***
Programs:	***2.200 programs allocated over 150 processors***
Accuracy:	***100 us. time-alignment accuracy within the distributed system***

Metrics: Code & Re-usability



- Product-line approach: total 6 Mln. LOC's
- HCI = C (X/Motif) → Java, Ada → Java
- generic-parts re-use: 95 %
- backwards-compatibility: 99%

- Generic high-level services
- 1 Major release/yr, 3 patch-releases/yr
- No project/customer-specific releases

- Splice-1 -> SpliceDDS -> OpenSplice

- Applications are unaware of OS & HW
- Major technology upgrades: every 2 yr
  - '94: SparcEngine 1E (SPARC)
  - '96: CPU2CE (microSparc-I)
  - '98: CPU5V (microSparc-II)
  - '00: Workstations (UltraSparc) & PPC (IO)
  - '02: Sparc/Solaris, PPC/vxWorks
  - '04: PC/Linux

Role of the DDS

- Focus is on information
  - That's the stable factor
- Provides scalability
  - Through publish - subscribe

- Provides a database view with fast and efficient access to the data
  - Track database with keyed data types, queries & filters
- Provides tuneable data transport & data storage services
  - Latencies, reliability, durability
- Provides logical partitioning of Publishers and Subscribers
  - Training & simulation
- Enables replication of system state and application state
  - Fault tolerance & Dynamic application management

QoS Policy Usage

DDS QoS Policy	DDS QoS Policy
DURABILITY	USER DATA
HISTORY	TOPIC DATA
READER DATA LIFECYCLE	GROUP DATA
WRITER DATA LIFECYCLE	PARTITION
LIFESPAN	PRESENTATION
ENTITY FACTOR	DESTINATION ORDER
RESOURCE LIMITS	OWNERSHIP
RELIABILITY	OWNERSHIP STRENGTH
TIME BASED FILTER	LIVELINESS
DEADLINE	LATENCY BUDGET
CONTENT FILTERS	TRANSPORT PRIORITY

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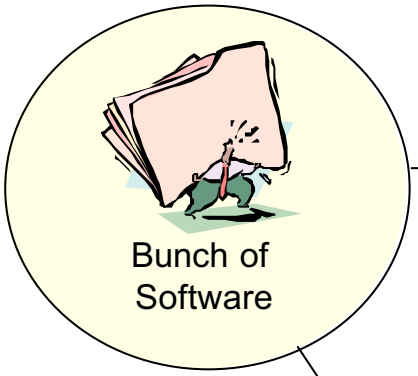
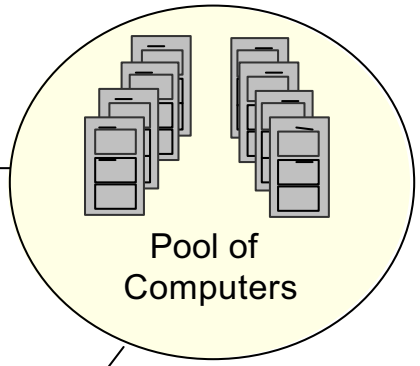
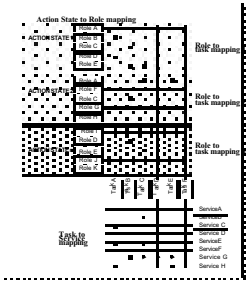
NOT USED (DEFAULT VALUE)

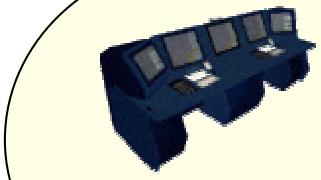
Dynamic Resource Management





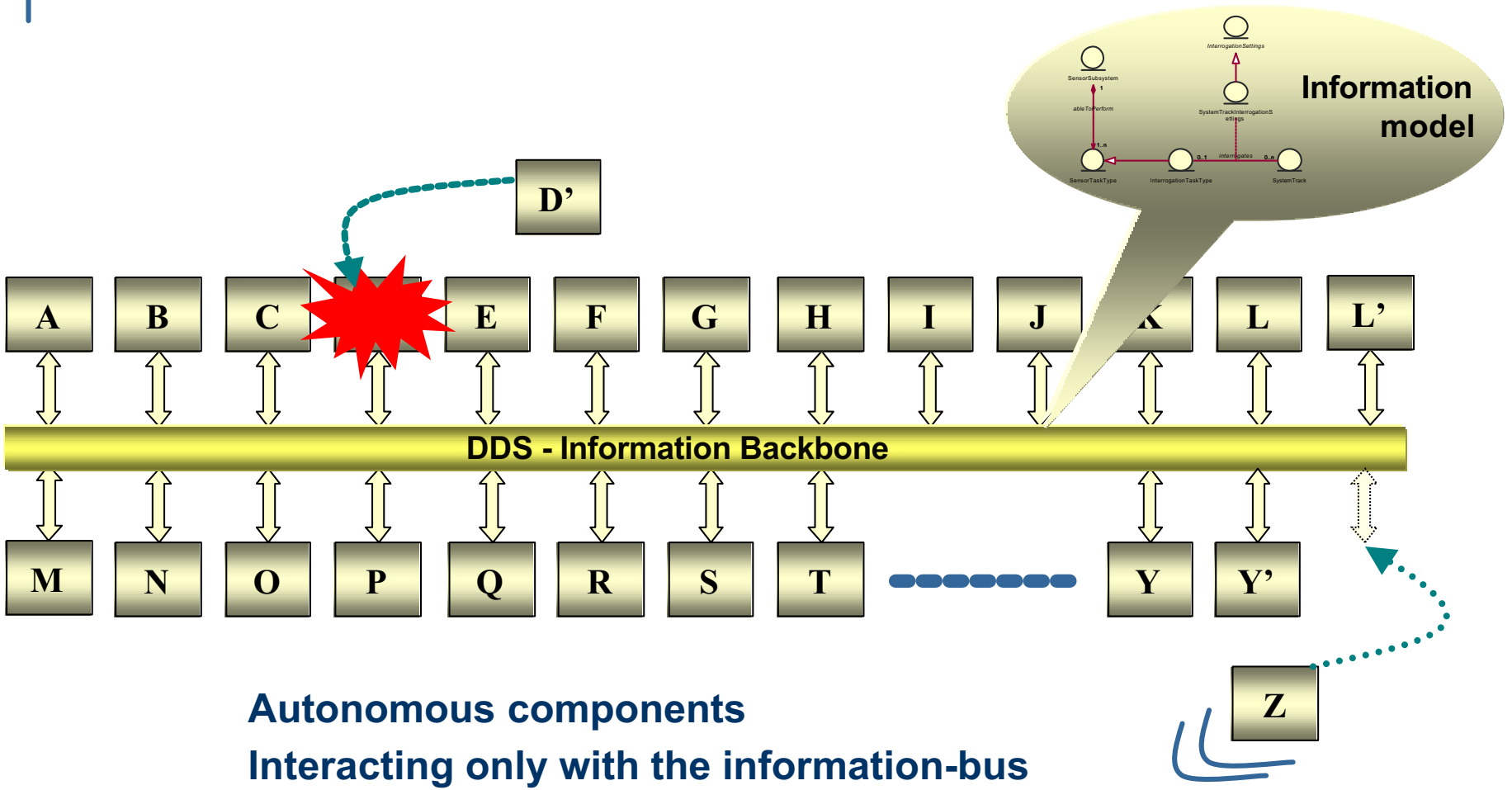
Architecture Model





- What – When – Where
  - Role dependant
  - Resource needs versus available resources
- Fault detection & Recovery
  - Functional degradation
- Software replication management
  - State replication & alignment

INFORMATION-CENTRIC ARCHITECTURE



Autonomous components

Interacting only with the information-bus

Spontaneous: Z, Self-healing: D'

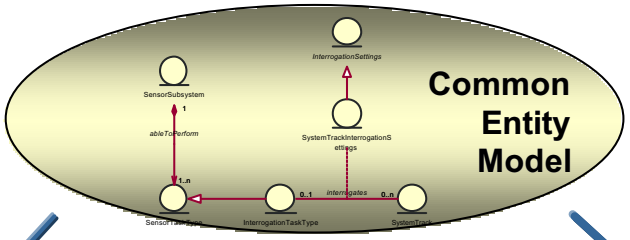
Redundant & Replicated: L', Y'

QOS-driven Data Distribution Service (reliability, persistency, latency): D D S

COMMON ENTITY MODEL : Deployment – F124

Design Authority
Joint Program Team

Joint Government
& Industry team



Common
Entity
Model

Standards based
ATP1, STANAG, ADaTP3

EADS

Thales

Raytheon

A B C D E F G H I J K L

DDS Information Backbone

DDS Information Day - DC

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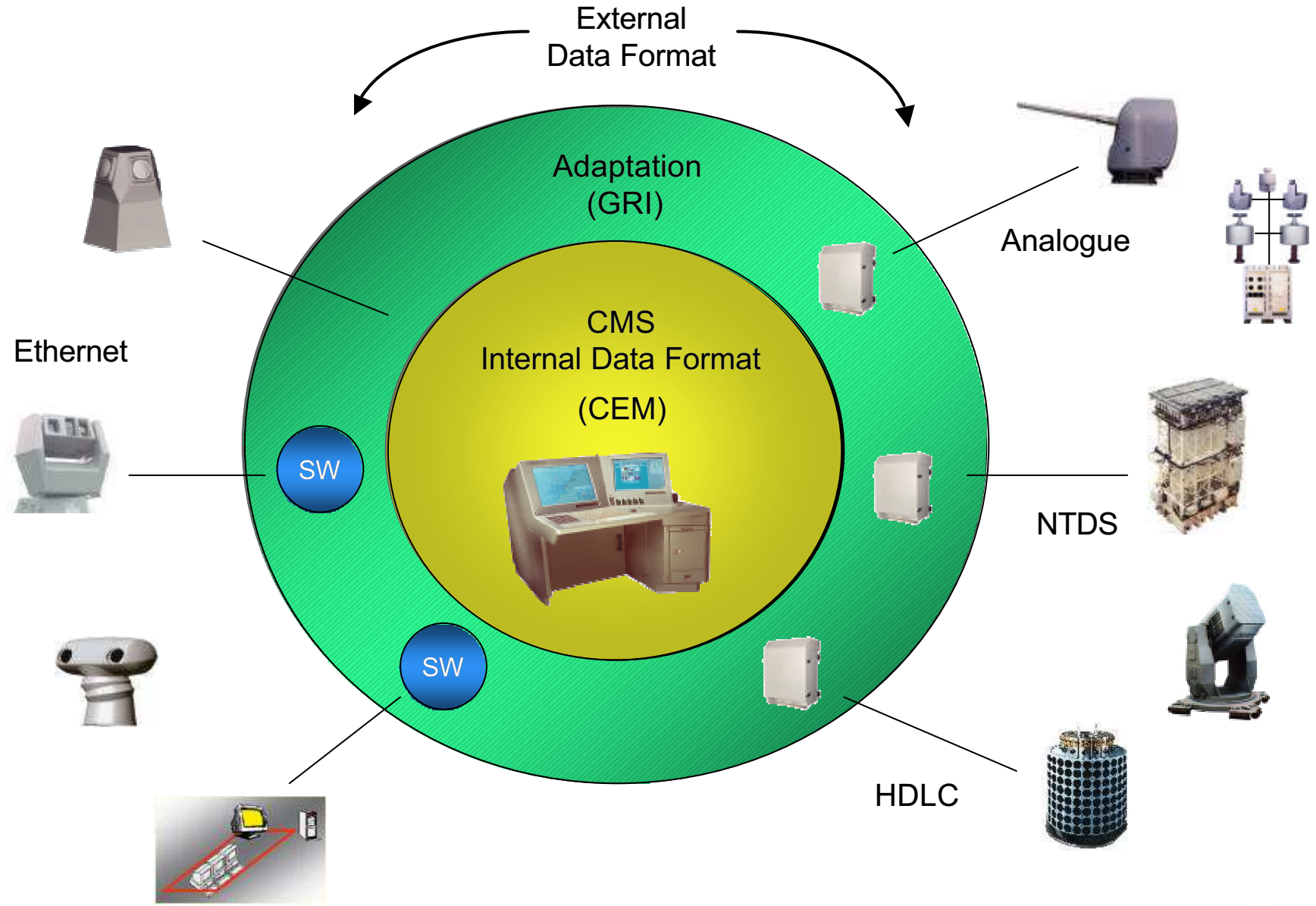
Integration of Subsystems



Openness: integration-capability

SURVEILLANCE	LINK	TRACKERS	MISSILES	GUNS	ECM
APAR, SMART-L SMART-S, MW08, DA08 VARIANT MRR SCOUT IRSCAN ESM DR3000 SKW, SLC KH 1007 NAV RAD SPS 64 NAV RAD RACAL NAV RAD BridgeMaster E Various other NAV RAD AWS 4, AWS 5, AWS 6 Dolphin AWS 9 SPS 49 Sea Giraffe AMB TRS 3D IFF MKX/XII (various) ESM SUSIE, APECS II ESM CUTLASS, ALTESSE INT/EXT COMMS (various)	LINK 10 LINK 11 LINK 14 LINK 16 LINK 22 (study) LINK Y LINK Y Mk2 VESTA INT/EXT comms	APAR STIR STING-EO LIROD Mk2 LIOD MIRADOR TMX AN/SPC CASTOR Vigy (study) MSP500 (study)	SSM HARPOON Exocet OTOMAT PENGUIN GABRIEL Polyphem NSM (study) RBS15 Mk3 SAM RAM Crotale BARAK SEAWOLF SADRAL VT1 SM1 and SM2 NSSM ESSM	Guns 127mm 115mm 100mm 76mm 57mm 40mm 30mm 25mm 27mm AK630 Ak176 AK306 (study) AK230 (study) Phalanx (TN)	Active EW APECS II ECM SALAMANDRE RDF MAIGRET ECM (various) Passive DAGAIE SAGAIE SRBOC/ALEX MASS SUPER BARRICADE
Integrated subsystems (own & 3rd party)					

Conclusions (1)

- The DDS provides the necessary non-functional properties for the TACTICOS CMS
  - Fault tolerance, scalability, low latency
- Use of the DDS allows for dynamic resource management
  - State replication
- The information centric approach allows for autonomous components, autonomous development and ease of integration

Conclusions (2)

DDS is Sailing the Seven Seas

Questions

Thanks for Your Attention