

Model-based Architecting and Optimization of Distributed Integrated Modular Avionics

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Nomenclature

Symbols

Caligraphic Symbols

Symbol	Unit	Description
$\mathcal{C}$		Capabilities
$ \mathcal{C} $		Number of capabilities per device
$\mathcal{D}$		Devices
$ \mathcal{D} $		Number of devices
$\mathcal{E}$		Power source
$\mathcal{I}$		Installation locations
$ \mathcal{I} $		Number of installation locations
$\mathcal{J}$		Cable route joints
$\mathcal{K}$		Device types (part number)
$ \mathcal{K} $		Number of device types
$\mathcal{L}$		Links
$\mathcal{N}$		Network comprising switches and links $\mathcal{N} = \{\mathcal{D}^{\text{Switch}}, \mathcal{L}\}$
$\mathcal{P}$		Peripherals
$\mathcal{Q}$		Peripheral wires connecting a DIMA device to peripherals
$\mathcal{R}$		Resources types
$ \mathcal{R} $		Number of device resource types
$\mathcal{S}$		Signals
$\mathcal{T}$		Tasks
$ \mathcal{T} $		Number of tasks
$\mathcal{U}$		Cable Routes
$\mathcal{W}$		Wire types

Gothic Symbols

Symbol	Unit	Description
$\mathfrak{A}$		Atomic constraint
$\mathfrak{D}$		Devices constraint
$\mathfrak{I}$		Installation location constraint
$\mathfrak{L}$		Latency constraint
$\mathfrak{P}$		Peripheral constraint
$\mathfrak{S}$		Segregation constraint
$\mathfrak{E}$		Power constraint

Greek Symbols

Symbol	Unit	Description
λ	$\frac{1}{s}$	Failure rate
ρ		Installation resources
Φ		Installation location resources types
$ \Phi $		Number of installation resource types

Latin Symbols

Symbol	Unit	Description
c	\$	Costs
$\hat{c}$	$\frac{\$}{\text{m}}$	Specific cost of cables
$\acute{c}$	$\frac{\$}{\text{s}}$	Specific cost per time
d		Device limitations in providing resources
l	m	Length or distance
m	kg	Mass
$\hat{m}$	$\frac{\text{kg}}{\text{m}}$	Specific mass of cables
p		Propability
r		Device resources
$ r $		Number of resource for all device types
$ r_{\mathcal{K}} $		Number of resource for a device type
t	s	Time
$ x^{\mathcal{D}} $		Number of devices assignment possibilities
$ x^{\mathcal{T}} $		Number of task assignment possibilities

Abbreviations

Abbrev.	Description
A	
AADL	= Architecture Analysis and Design Language
ADCN	= Aircraft Data and Communication Network
AFDX	= Avionics Full Duplex switched ethernet
AIMS	= Airplane Information and Management System
API	= Application Programming Interface
AS	= Avionics Server → CPM
ATA	= Air Transport Association
ATM	= Anyone-To-Many
B	
BAG	= Bandwidth Allocation Gap → AFDX
BAS	= Bleed-Air System
BCD	= Binary Coded Decimal
BP	= Binary Programming (Program)
C	
CAN	= Controller Area Network
CCE	= Concurrent Configuration Engineering
CCS	= Common Core System
COTS	= Commercial-Off-The-Shelf
CPM	= Core Processing Module
CP	= Combined Protocol → A629
CPIOM	= Core Processing Input and Output Module
CRDC	= Common RDC
CSP	= Constraint Satisfaction Problem
D	
DAL	= Design Assurance Level
DIMA	= Distributed Integrated Modular Avionics
DME	= Distribute Modular Electronics
DSP	= Digital Signal Processor

Abbrev.	Description
E	
E/E	= Electrical and Electronic
EIS	= Entry Into Service
EMF	= Eclipse Modeling Framework
EMI	= ElectroMagnetic Interference
EPTAS	= Efficient PTAS
F	
FA	= Federated Avionics
FDS	= Fire Detection System
FIFO	= First In First Out
FTU	= Fault Tolerant Unit → TTP
FPTAS	= Fast PTAS
G	
GAP	= General Assignment Problem
GPM	= General Processing Module
H	
HP	= High-Performance → CPM
I	
I/O	= Input/Output
IMA	= Integrated Modular Avionics
IOM	= Input and Output Module
IP	= Integer Programming (Program) Internet Protocol
IPC	= Initial Provisioning Costs
L	
LP	= Linear Programming (Program)
LSP	= Lightning Strike Protection

Abbrv.	Description
M	
MAF	= MAjor (time) Frame → A653
MEL	= Minimum Equipment List
MILP	= Mixed Integer Linear Programming (Program)
MIPS	= Million Instructions Per Second
MMEL	= Master Minimum Equipment List
MO	= Multi-Objective
MOIP	= Multi-Objective Integer Programming (Program)
MTBF	= Mean Time Between Failure
MTBUR	= Mean Time Between Unscheduled Removal
MTTR	= Mean Time To Repair
N	
NFF	= No Failure Found Rate
NVM	= Non-Volatile Memory
O	
OHDS	= OverHeat Detection System
OIC	= Operational Interruption Costs
OS	= Operating System
P	
PP	= Pin Programming
PS	= Pneumatic System
PTAS	= Polynomial-Time Approximation Scheme
PTP	= Pear-To-Pear
Q	
QP	= Quadratic Programming (Program)
QCQP	= Quadratically Constrained QP
R	
RDC	= Remote Data Concentrator
RIU	= Remote Interface Unit
RPIOM	= Remote Processing and I/O Module
RTOS	= Real-time Operating System

Abbrev.	Description
S	
SAT	= (Boolean) SATisfiability
SDI	= Source/Destination Identifier → A429
SG	= Synchronization Gap → A629
SOS	= Special-Ordered-Sets
SSC	= Ship-Set Costs → A429
SSM	= Status/Sign bits → A429
T	
TC	= Time-Critical → CPM
TI	= Transmit Interval → A629
TDMA	= Time Division Multiple Access
TLM	= Transaction Level Model → SystemC
TTP	= Time Triggered Protocol
U	
UDP	= User Datagram Protocol
V	
V&V	= Verification and Validation
VCS	= Ventilation Control System
VL	= Virtual Link → AFDX
W	
WCET	= Worst Case Execution Time
