
THE WORLDWIDE MERCHANT EMBEDDED COMPUTING MARKET

2018 EDITION

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Table of Contents

Chapter 1 INTRODUCTION	1
1.1 Objectives of the Report	1
1.2 Scope of the Report	1
1.2.1 Market Definitions	1
1.2.1.1 What Is Merchant Embedded Computing?.....	2
1.2.1.2 What Is NOT Included in the MEC Definition?	3
1.2.1.3 Who Are the “Merchants” of Embedded Computing?.....	4
1.2.2 Market Segmentation	4
1.2.2.1 Five Application Areas.....	4
1.2.2.2 MEC Suppliers and EMS Contract Manufacturers.....	5
1.3 Report Organization.....	5
1.3.1 Methodology.....	5
1.3.2 Chapter Structure.....	6
Chapter 2 EXECUTIVE SUMMARY	7
2.1 Introduction	7
2.2 MEC Industry Trends	7
2.3 Embedded Computing Application Markets.....	11
2.4 MEC Standards-Based Application Markets	12
Chapter 3 TECHNICAL TRENDS	14
3.1 Industry Overview	14
3.1.1 Introduction	14
3.1.2 Early Market Drivers	15
3.1.3 “Open Bus” Architectures	16
3.1.4 Emerging Technologies	18
3.2 Broad Market Trends	19
3.2.1 Major Changes and Initiatives.....	19

3.2.2	Microprocessor Trends	21
3.2.3	DSP and FPGA Trends.....	22
3.2.4	Competing Processor Unit Trends	23
3.2.5	CCIX Consortium	24
3.2.6	Silicon Photonics	25
3.2.7	3DIC.....	25
3.2.8	Operating Systems	26
3.2.9	General Conclusions.....	26
3.3	VMEbus International Trade Association (VITA)	27
3.3.1	2eSST (VITA 1.5) – 2-edged Source-Synchronous Transfers	28
3.3.2	Serial I/O on VME64x (VITA 31) – Serial with Ethernet Added	30
3.3.3	PMC (IEEE 1386.1) – PCI Mezzanine Card	31
3.3.4	PrPMC (VITA 32) – Processor PMC.....	32
3.3.5	PMC-X or PCI-X PMC (VITA 39)	34
3.3.6	VXS or VMEbus Switched Serial (VITA 41)	34
3.3.7	XMC (VITA 42) – Switched Mezzanine Card.....	36
3.3.8	VPX (VITA 46) – Designed for Harsh Environments	37
3.3.9	ANSI (VITA 47) – Ruggedized Enhanced Design Implementation	39
3.3.10	REDI (VITA 48) – Ruggedized Enhanced Design Implementation	40
3.3.11	FMC (VITA 57.1) – FPGA I/O Mezzanine Card	41
3.3.12	LRIE (VITA 58.0) – Line Replaceable Integrated Chassis.....	41
3.3.13	OpenVPX (VITA 65) Industry Working Group.....	41
3.3.14	VPX (VITA 66) Fiber-Optic Connectivity	42
3.3.15	VPX (VITA 67) Analog and RF I/O	42
3.3.16	VNX (VITA 74) NanoX Small Form Factor	43
3.3.17	SpaceVPX (VITA 78).....	43
3.4	PCI Industrial Computer Manufacturers Group (PICMG)	45
3.4.1	PCI-ISA (PICMG 1.x).....	46
3.4.1.1	ePCI-X (PICMG 1.2) – adds PCI-X.....	47
3.4.1.2	PCI Express (PICMG 1.3) – SHB Express	47

3.4.2	CompactPCI (PICMG 2.x) – PCI with Rugged Connectors	48
3.4.2.1	CompactPCI Serial	52
3.4.3	AdvancedTCA (PICMG 3.x) – Adds ATCA to PCIMG	53
3.4.3.1	Base Specification (PICMG 3.0)	54
3.4.3.2	Ethernet (PICMG 3.1)	55
3.4.3.3	InfiniBand (PICMG 3.2).....	56
3.4.3.4	StarFabric (PICMG 3.3).....	56
3.4.3.5	PCI Express (PICMG 3.4)	56
3.4.3.6	RapidIO (PICMG 3.5).....	56
3.4.3.7	Extensions for Applications Outside the Telecom Central Office (PICMG 3.7)	56
3.4.3.8	xTCA for Physics (PICMG phyTCA).....	57
3.4.4	Advanced Mezzanine Card (AMC).....	57
3.4.5	MicroTCA (MTCA.0).....	59
3.4.6	Hardware Platform Management (HPM).....	61
3.5	PC/104 Embedded Consortium.....	62
3.5.1	PC/104.....	64
3.5.2	PC/104-Plus	66
3.5.3	PCI-104	66
3.5.4	PCI/104-Express and PCIe/104	67
3.5.5	EBX and EBX Express	68
3.5.6	EPIC and EPIC Express	70
3.6	Open Compute Project (OCP)	72
3.7	Motherboard Form Factors – Intel and Via Technologies.....	75
3.7.1	ATX	76
3.7.2	MicroATX.....	77
3.7.3	FlexATX.....	78
3.7.4	BTX	78
3.7.5	Mini-ITX	79
3.7.6	Nano-ITX.....	80
3.7.7	Pico-ITX.....	80
3.8	Computer on Module (COM)	80

3.8.1	ETX – Embedded Technology eXtended	81
3.8.2	COM Express (PICMG COM.0).....	82
3.8.3	XTX	85
3.8.4	Rugged System-on-Module Express (VITA 59).....	86
3.8.5	Qseven	86
3.8.6	CoreExpress.....	88
3.8.7	SMARC.....	89
3.8.8	Embedded NUC.....	91
3.8.9	COM Express Mini	92
3.8.10	Freescale I.MX6.....	92
3.8.11	ARM Cortex A9.....	93
3.9	SFF-SIG: Small Form Factor Special Interest Group	93
3.9.1	SUMIT Interface	94
3.9.2	COMIT	95
3.9.3	XR-DIMM™	96
Chapter 4 ECONOMIC OUTLOOK AND WORLDWIDE ELECTRONICS INDUSTRY FORECAST		97
4.1	World and Semiconductor Overview	97
4.2	Trends to Watch in 2018	99
4.3	World GDP.....	100
4.4	Global Electronics Market	104
4.5	Electronics Industry Summary Forecast	106
4.5.1	Communications	106
4.5.1.1	Cellular Handsets.....	108
4.5.1.2	Cellular Infrastructure	109
4.5.1.3	Other Phones	111
4.5.1.4	Enterprise LANs.....	111
4.5.1.5	Wireless LANs	112
4.5.1.6	DSL and Cable Modems.....	113
4.5.1.7	PBX/Other CPE.....	113
4.5.1.8	Carrier-Class Equipment.....	114

4.5.1.9	Other Communications Equipment	115
4.5.2	Computers.....	115
4.5.2.1	Personal Computers	118
4.5.2.2	Tablets.....	118
4.5.2.3	Servers.....	119
4.5.2.4	Workstations.....	119
4.5.2.5	Storage Systems	119
4.5.2.6	Flash/Hard Drives	120
4.5.2.7	Monitors	120
4.5.2.8	Printers.....	121
4.5.2.9	E-Readers	121
4.5.2.10	Computer Internet of Things	122
4.5.3	Consumer	123
4.5.3.1	Televisions.....	125
4.5.3.2	Set-Top Boxes	125
4.5.3.3	DVD Players/Recorders.....	126
4.5.3.4	Digital Cameras.....	126
4.5.3.5	Console Video Games.....	126
4.5.3.6	MP3 Players.....	127
4.5.3.7	Personal Navigation Devices.....	127
4.5.3.8	Consumer Internet of Things	127
4.5.4	Industrial	128
4.5.5	Medical.....	130
4.5.6	Automotive	133
4.5.7	Commercial Aviation, Defense, and Other Transportation	135
4.5.8	Home/Commercial/Government Internet of Things	138
Chapter 5 MEC MARKET FORECASTS, 2015–2022		140
5.1	Chapter Overview	140
5.2	Assembly – Total Available Market.....	140
5.2.1	Electronics Assembly Overview	140
5.2.1.1	Standards-Based Merchant Embedded Computing.....	143

5.2.2	Communications Assembly	146
5.2.2.1	Standards-Based Communications Merchant Embedded Computing.....	149
5.2.3	Industrial Assembly	152
5.2.3.1	Standards-Based Industrial Merchant Embedded Computing	154
5.2.4	Medical Assembly	156
5.2.4.1	Standards-Based Medical Merchant Embedded Computing	160
5.2.5	Aerospace/Military Assembly	163
5.2.5.1	Standards-Based Aerospace/Military Merchant Embedded Computing	167
5.2.6	Other Assembly.....	170
5.3	Corporate Strategy.....	172
5.3.1	Outsourcing.....	172
5.3.2	Partnerships and Joint Ventures	173
5.3.3	Mergers and Acquisitions	176
5.3.4	Industry Consolidation	179
5.4	Competitive Strategies	179
5.4.1	Time to Market	180
5.4.2	Life Cycle Management.....	180
5.4.3	Intellectual Property	181
5.4.4	Margin versus Volume	182
5.5	The Standards Environment	182
5.5.1	Proliferation of Standards-Based Architectures	182
5.5.2	Standards Consortia.....	183
Chapter 6	MEC COMPETITIVE RANKING	185
6.1	Chapter Overview	185
6.2	Standards-Based MEC Suppliers	185
6.3	Non-Standards-Based MEC Suppliers.....	188
Chapter 7	COMPANY PROFILES.....	192
7.1	Overview of Profiled Companies	192
	AAEON Technology, Inc. (an ASUS-associated company).....	193
	Abaco Systems.....	195

Acromag, Inc.	196
Acrosser Technology Co., Ltd.	198
ADLINK Technology, Inc.	200
Advantech Co., Ltd.	202
Aitech Defense Systems, Inc.	205
Alpha Data	207
Alphi Technology Corp.	208
Annapolis Micro Systems, Inc.	209
ARBOR Technology Corporation	210
Artesyn Embedded Technologies	212
AudioCodes, Ltd.	215
Avalue Technology, Inc.	217
AXIOMTEK Co., Ltd.	219
b-plus GmbH	221
BittWare	223
CommAgility	224
Concurrent Technologies Plc	225
congatec AG	226
Connect Tech, Inc.	228
Cornet Technology, Inc.	230
Critical I/O, LLC	232
Curtiss-Wright Defense Solutions	233
Cyclone Microsystems, Inc.	236
Data Device Corporation	238
DFI, Inc.	240
Dialogic, Inc.	242
Diamond Systems Corporation	244
Ducommun, Inc.	246
Electronic Equipment Produktion & Distribution GmbH	247
Elma Electronic AG	249
ELTEC Elektronik AG	251

Embedded Planet, Inc.	252
Eurotech Group.....	253
EVOC Intelligent Technology Co., Ltd.....	255
Exceet Medtec Romania	256
Extreme Engineering Solutions, Inc. (X-ES).....	258
Fastwel	260
Galleon Embedded Computing AS.....	262
Garz & Fricke GmbH.....	263
General Micro Systems, Inc.	264
Hectronic AB	266
HEITEC-Group.....	268
I-Bus Corporation	270
IEI Integration Corp.	271
Interface Concept.....	272
IOxOS Technologies	274
iWave Systems Technologies Pvt., Ltd.....	275
Kontron S&T AG	277
Lanner Electronics, Inc.	279
LCR Embedded Systems	281
Leonardo MW, Ltd.	282
MEN Mikro Elektronik GmbH.....	283
Mercury Systems, Inc.....	284
Micro/sys, Inc.....	286
MPL AG	287
MSC Technologies GmbH.....	288
N.A.T. GmbH	291
Nallatech	292
NEXCOM International Co., Ltd.....	294
Nutaq Inc.	296
Octagon Systems.....	297

One Stop Systems, Inc.....	298
Pactron, Inc.	299
PCI-Systems, Inc.	300
Pentair Technical Solutions.....	301
Pentek, Inc.	303
Pixus Technologies.....	305
Portwell, Inc.	306
RadiSys Corporation.....	308
RTD Embedded Technologies, Inc.....	310
SECO srl	312
Shenzhen NORCO Intelligent Technology Co., Ltd.....	314
ShiraTech	316
SKY Computers, Inc.	318
Solectrix GmbH	320
Technobox, Inc.	322
TEK Microsystems, Inc. (Tekmicro)	323
TES Electronic Solutions, GmbH.....	325
TEWS TECHNOLOGIES GmbH.....	327
Themis Computer SALR.....	328
Trenton Systems, Inc.....	329
Trident Infosol.....	331
V Rose Microsystems, Inc.	332
VadaTech, Inc.....	334
VersaLogic Corporation.....	335
VIA Technologies, Inc.	336
WinSystems, Inc.	338
Glossary – Embedded Computing Terminology	339



Buses: VME, PCI, PCIE, cPCI, PC/104, COM, SFF, ATCA, AMC, PMC

Chapter 1

INTRODUCTION

1.1 Objectives of the Report

This *Worldwide Merchant Embedded Computing Market Report, 2018 Edition* provides a macroeconomic analysis of the global marketplace for standards-based single-board computing systems and solutions. The report examines the total available market, its size, trends and technologies of the market, and the opportunities for companies that compete in this space. It provides an overview of technological advances and the development of various product specifications, and trends and issues of importance to the industry, as well as the market forces that are changing the nature of the business, including outsourcing trends and the impact of industry consolidation by mergers and acquisitions. The report analyzes various business issues and forecasts the market size and growth for the major segments and technologies. Data used for these forecasts is current as of March 2018. Finally, the report profiles selected vendors, and gives a summary of their business in terms of size and market segments.

The worldwide MEC report is designed to aid executives in senior management, sales, business development, and marketing among current and potential manufacturers, and users of embedded computing products, in making important strategic and product decisions.

1.2 Scope of the Report

1.2.1 Market Definitions

The MEC marketplace is extremely complex, encompassing a large array of technologies, standards, form factors, and products; therefore, defining the precise dimensions that comprise this report is difficult. There are many overlaps in products and markets. Attempting to put everything into neat categories does not always work to everyone's satisfaction, which makes markets hard to size and issues difficult to characterize.

The term “embedded computing” has become a favorite buzzword in high-tech circles. It is freely used throughout the industry to refer to anything that can be characterized as a computer in a box, whether it is to be used for industrial, military, or commercial purposes. If it consists of a printed circuit board with a microcontroller and other components (memory or I/O, for example) attached, and is assigned a specific performance task as part of a subsystem within a larger device, it can often qualify as an embedded system.

According to Jerry Gipper, Executive Director of the VITA trade association (i.e., the VMEbus International Trade Association), “The best way to look at embedded is really the end function of the computer. If it is truly embedded (inside something or tightly attached) and dedicated to a specific function, then these products represent the systems that must be “able” in many dimensions: dependable, supportable, configurable, reliable, serviceable—in another word, it relates to “mission-critical systems” [that] are intended to operate flawlessly to protect life, property, equipment, and the environment. Moreover, they rely on the durable products of today and tomorrow using VITA Technologies.”

In the following sections, we will try to specify exactly how the term is used within the context of this report.

1.2.1.1 What Is Merchant Embedded Computing?

Merchant embedded computing (or MEC) is defined as a standards-based computer system consisting of a single-board computer or a series of boards and a backplane. The key differentiator from a simple embedded computing device is the inclusion of the requirement that an MEC system supports an industry standard bus architecture for the signaling, bus, connectors, and physical form factors. It is usually in a pluggable format with multiple boards. MEC boards are designed for multiple applications and (usually) not a single, dedicated application. In addition:

- MEC systems are usually products available from multiple vendors, offering a variety of “off-the-shelf” boards available from merchant vendors within the open market.
- The system may run a proprietary operating system or a generic off-the-shelf operating system, with the application software usually product specific.
- The operating and application systems are not exposed to the end user, nor can the user change or run general-purpose applications software.

- Generally, the user does not see the actual function of the computer inside but may only access its operation with a button control panel, menu system, or screen with a dedicated application.

Typical MEC applications might include use in a medical scanner, industrial robot, manufacturing process control system, various communications equipment, complex military equipment, etc. Some embedded computing systems are operated in such a manner that the computer function is not apparent in the final application, while other embedded systems are clearly operated by computers that are integrated into a machine’s functionality. An example of the former is the highly complex imaging system of a CAT, PET, or MRI diagnostic system or an industrial automation robot.

1.2.1.2 What Is NOT Included in the MEC Definition?

Logically, we consider “a microprocessor on a board of electronics” as including a much broader market than is covered in this report, especially if the item in question does not conform to an industry bus standard. Such a product could encompass virtually everything with a microprocessor. Other factors that exclude particular products or devices from consideration include:

- Single application-specific microcontroller-operated products—“single” applications such as a musical greeting card, appliance, toy, stereo system, thermostat, etc., or any device that embeds a microprocessor of some kind
- Complex, single-chip embedded solutions and systems on chip (SoCs)
- Consumer PC motherboards and add-in boards, as well as data center server boards

To be sure, PC motherboards are bus-based and popular in many industrial applications. However, most such products are designed primarily for general desktop applications, not for dedicated applications. Capturing data on PC-grade motherboards that are used in the embedded market is quite difficult, especially because a large percentage of such boards are sold through commercial channels. In the context of this report, motherboards sold by merchant vendors are included in our “PC/104, EPIC, EBX, ATX, and ITX” architecture category, as they typically have been

enhanced beyond the normal PC-grade quality used to run Windows and other general-purpose computer operating systems.

1.2.1.3 Who Are the “Merchants” of Embedded Computing?

The MEC business consists of several dozen large companies with diversified product portfolios and well over a hundred or more small companies targeting product niches, often with special, long-established relationships with buyers. Many, if not most, of the competitors have been in existence for 15 to 20 years or more. Not surprisingly, with so many competitors the vendor landscape is in continuous flux. Several of the companies profiled in NVR’s last MEC report are gone, either having been acquired by larger competitors or having simply closed their doors.

Given the number of vendors in the market, operating from countries across the globe, detailed data is often not available in all cases. MEC products number in the thousands and unit shipments in the hundreds of thousands. Therefore, much of the data provided about the market and about the marketers must be estimated based on the information and data that is available.

1.2.2 Market Segmentation

This report sizes the major applications and segments by revenue as well as analyzes both market and technology trends and key issues facing MEC executives. Analyses are provided for both standards-based assemblies and non-standards-based MEC assemblies.

1.2.2.1 Five Application Areas

While there are hundreds of subapplications, MEC vendors generally compete in five broad vertical market application categories:

1. Communications (cellular infrastructure, CPE, etc.)
2. Industrial (process control, test and measurement, and other)
3. Medical (diagnostics/imaging, therapeutic, and surgical/monitoring)
4. Military/Aerospace (flight navigation, weapons, C3, and other)
5. Other (automotive, off-road, ships, trains, kiosks, etc.)

Each of these application areas typically has unique product characteristics and operating environments. Military/aerospace applications, for example, require battlefield-rugged architecture, whereas medical equipment typically operates in the “72 degrees and fluorescent lighting” environment of a hospital. Industrial automation boards may be used in process control, mining, chemical, or agricultural equipment, or in a production line robot. Communication boards might be focused on high-speed, optical transfer data rates. Outside plant equipment often operates in harsh environments and requires the ability to withstand -40°C to $+80^{\circ}\text{C}$ temperatures and greater levels of shock, vibration, humidity, and electrostatic discharge.

1.2.2.2 MEC Suppliers and EMS Contract Manufacturers

For the first time, we have focused on tracking the ecosystem of MEC suppliers and their sales by market application. This focus was chosen in place of tracking product sales by industry standard or form function, as this was reported to be more relevant. In addition, our customers wanted more information on the total available market, which included non-standards-based MEC assemblies. For this reason, we have added a new chapter that reports on the top 89 MEC standards-based suppliers with the leading 81 EMS contract manufacturing companies across their main application industries.

1.3 Report Organization

1.3.1 Methodology

The information presented in this report was gathered from a variety of sources. The primary sources were engineering, marketing, business development, and communications managers in merchant embedded computing companies who were contacted directly. These individuals were asked to respond to a survey. In some cases, the answers to the survey were delivered as written responses. In other cases, the information was conveyed via telephone interviews.

The secondary sources were company literature, such as websites, investment reports (e.g., annual reports and SEC filings), white papers, and press releases; investor analyses; and trade publications.

1.3.2 Chapter Structure

This report is organized into seven chapters plus an appendix:

- Chapter 1, Introduction: this chapter outlines the scope and organization of the report.
- Chapter 2, Executive Summary: provides an overview of the market and highlights of the top-level market segments.
- Chapter 3, Technical Trends: presents key technology issues that are affecting the embedded computing market today and that will impact the future market environment. This chapter also provides a quantitative analysis of the market over the past decade.
- Chapter 4, Economic Outlook and Worldwide Electronics Industry Forecast: provides recent historical data and trends as well as analysis and forecasts for the marketplace.
- Chapter 5, MEC Market Forecasts, 2015–2022: analyzes the key issues and trends by the five application areas defined in the report.
- Chapter 6, MEC Competitive Ranking: lists leading suppliers for both the standards-based and non-standards-based product assemblies and shows their leading market segments.
- Chapter 7, Company Profiles: provides profiles of the key vendors competing in the MEC marketplace.
- Glossary of Terms: short descriptions of many of the technical and trade terms used in the report.