

# High-Speed Serial Backplane Architectures

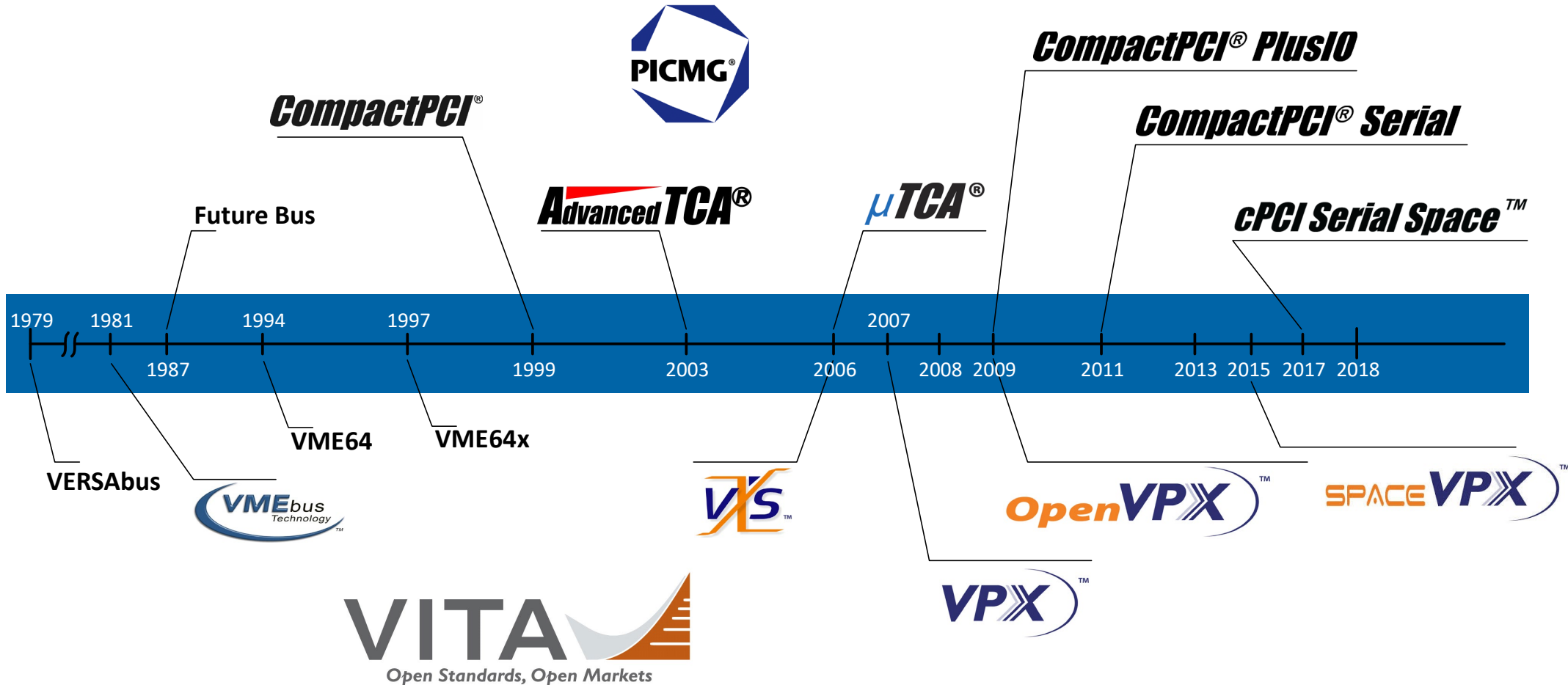
VPX, CPCI-Serial, xTCA – A Comparison

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- Historical Review
  
- Technical Comparison
  
- Market View
  - Distribution by Architecture
  - Acceptance by Market Segment
  
- „Commercial View“
  - Availability of Off-the-Shelf Solutions
  - Costs
  
- Summary and Conclusions

# Historical Review



# Technical Comparison

	CompactPCI Serial		VPX/OpenVPX		xTCA	
	3U	6U	3U	6U	ATCA	mTCA
Connector bandwidth	> 12.5 GHz		up to 6.25 GHz (VITA46.0) or up to 10 GHz (VITA 60.0)		>10 GHz	up to 12 GHz
Number of Differential Pairs	152	160	64	192	200	40
Connectors Pinout	Defined by CompactPCI-Serial Specification		Defined by Profiles for modules, Slots and Crosspanels	Defined by Profiles for modules, Slots and Crosspanels	Defined by ATCA Specification	Defined by mTCA Specification
Base High Speed Interconnect	PCI-E SRIO: 2x8 and 6x4 channels		PCI-E, SRIO, Infiniband, Ethernet, SATA, SAS: up to 20 x 4 depending on topology (Star, Dual Star, Extended Star, Daisy Chain, Mech, Ring...) and Profile		Defined by PICMG3.4 (PCI-E) Devined by PICMG3.5 (SRIO)	PCI-E x4 Gen1-3 SRIO 40GbE
Common Interconnect	1/10 GE: 8 channels, Single Mesh	1/10 GE: 8 channels, Single Mesh and 2 to crosspanel			Defined by PICMG3.1 (ETH) Defined by PICMG3.2 (InfiniBand)	10 GE
Storage Interconnect	SATA/SAS: 8 channels	SATA/SAS: 8 channels			none	SATA only via module-to-module direct connectivity
General I/O Interconnect	USB 2.0/3.0: 8 channels		none		none	none
Switches for Serial Interconnects	Embedded into CompactPCI-S System Controller (based on capability of modern CPUs platforms)		Separated VPX System module(s)/component(s)		Via separate switch blade	Via separate module
Power Supply	79.8 W@12 V optional 4.75 W@5 V Stdby	171 W / 12 V optional 23.75 W@5 V Stdby optional 91.2 W / 48 V	276 W@12 V more combinations with supply voltages 3 V, 5 V and 12 V	768 W@48 V more combinations with supply voltages 3 V, 5 V and 12 V	up to 400 W@48V	80 W@12 V (split to 50 W for front and 30 W for RTM)
Conduction Cooling	via standard module encapsulation and standard HP slot pitch		via initial module design for conduction cooling with reduced board space for components placement		not available	Defined by PICMG MTCA.3 R1.0
Compatibility of Modules	Guaranteed by CompactPCI-S Specification Compliance		within: 1) Profiles and 2) connectors (VITA 46.0 or 60.0)	within: 1) Profiles and 2) Connectors (VITA 46.0 or 60.0) and 3) Input Power scheme	Guaranteed by ATCA Specification Compliance; Topology of backplane is important	Guaranteed by mTCA Specification Compliance; Topology of backplane is important

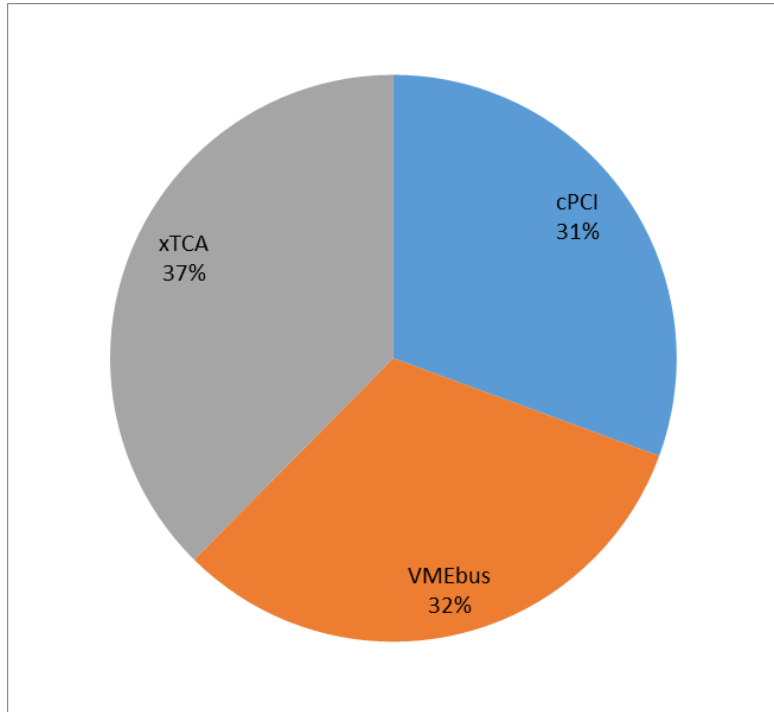
	CompactPCI-Serial	VPX	AdvancedTCA	μTCA
Bandwidth (3U/6U)	++ / ++	o / ++	++	o
User Defined I/O	o	++	+	o
Power Envelope	o	++	+	o
Ruggedness	+	++	+	+
Conduction Cooling	++	++	--	+
Simplicity	++	-	o	+
Compatibility	++	-	+	+

Rating:      very bad | bad | mediocre | good | very good  
                  --       -       o       +       ++

# Market View

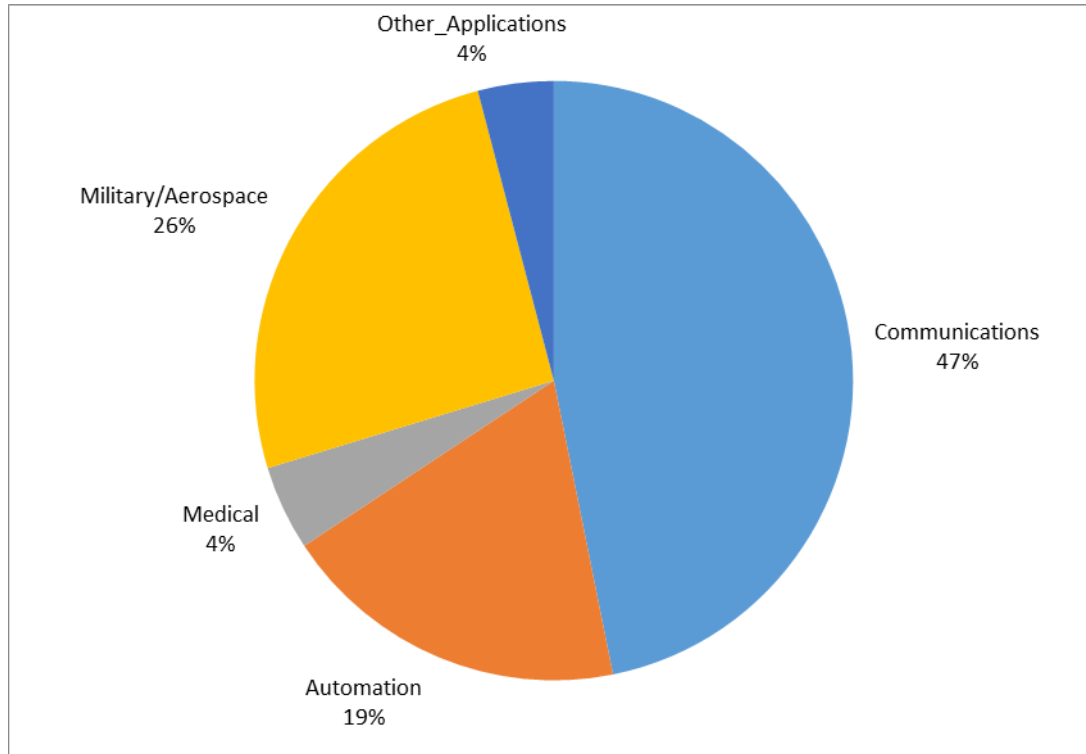
By Architecture  
By Market Segment





- Total market size of Merchant Embedded boards and systems across all market segments and sub-architectures „guesstimated“ at ~3,500...4,500 Mio. US-\$
- Three leading standard backplane base architectures shared the market nearly equally
- Growth forecasted for all three architectures
- However: significant differences once we drill deeper...

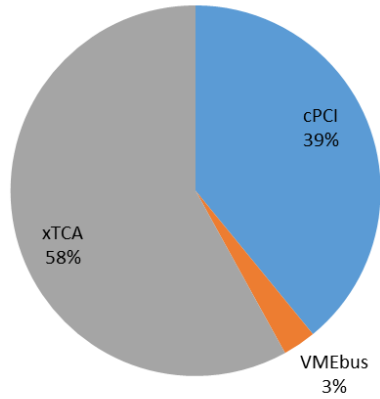
Source: New Venture Research Corp., 2016-2018



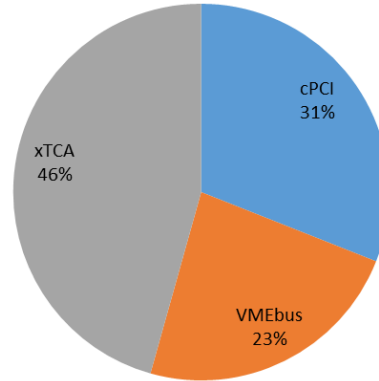
Source: New Venture Research Corp., 2016-2018

- No major change of this split forecasted
- Communications was, is and continues to be the major user of open standards based backplane architectures
- Mil/Aero continues to be strong and important
- Automation continuing to find niches where high performance, scalable systems are required

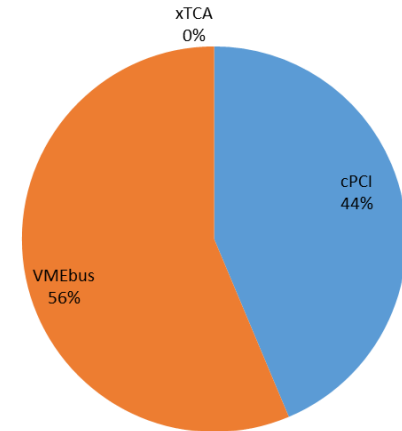
## Communications



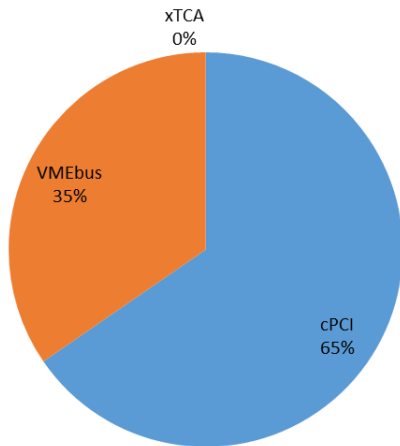
## Automation



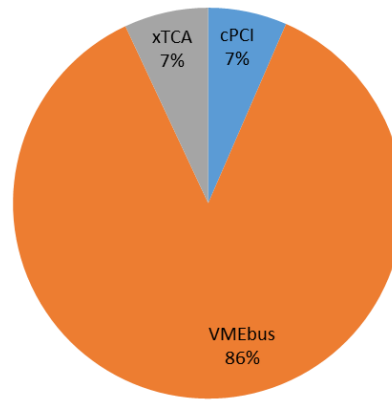
## Other Applications



## Medical



## Military/Aerospace

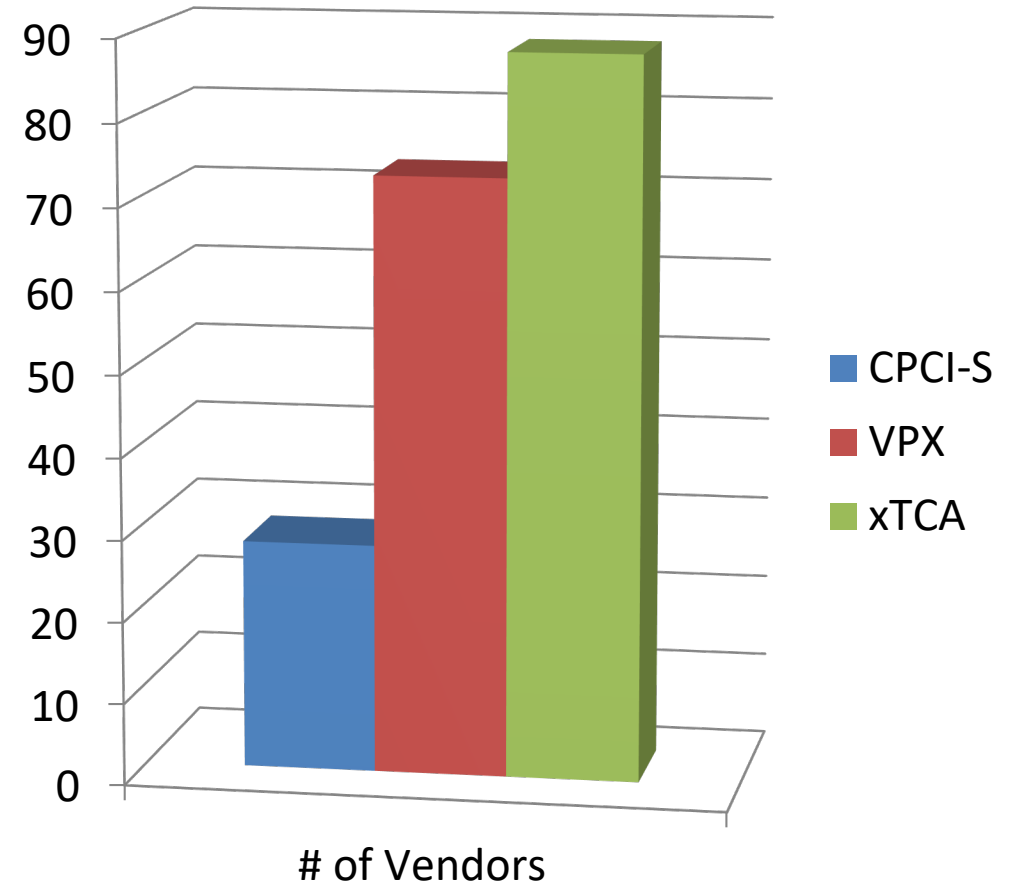


# „Commercial“ View

Availability

Costs

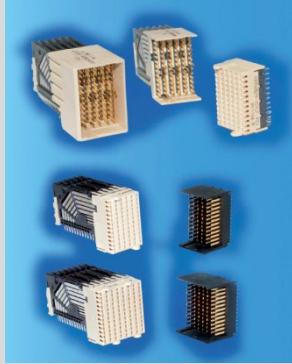
- Results of an empirical study:
  - Search for vendors of products based on these architectures
  - Search engines (Google etc.) and trade associations (VITA, PICMG)
- CPCI-Serial: mainly European and Asian vendors
- VPX: mainly North American vendors
- xTCA: vendors from all continents



## CompactPCI-Serial

### Connectors

- E.g. Amphenol, FCI
- Costs for a typical 3U board:  
**~60 US-\$**



### Boards

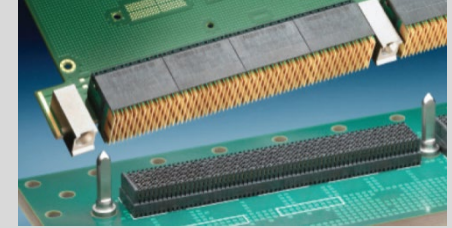
- CPU board with certain functionality (3<sup>rd</sup> generation i7, 8 GB ECC RAM,...)
- Market price:  
**~4,400 US-\$**



## VPX

### Connectors

- E.g. Amphenol, TE Connectivity
- Costs for a typical 3U board:  
**~ 220 US-\$**



### Boards

- CPU board with same functionality (3<sup>rd</sup> generation i7, 8 GB ECC RAM,...)
- Market price:  
**~5,900 US-\$**



## CompactPCI -> Serial

- › Easy to use, limited options, thus very compatible
- › Very cost competitive
- › Also rugged options
- › Strong in automation and medical
- › Strong in Europe and Asia
- › Still weak in the US
- › Potential to gain more acceptance in the US

## VME -> VPX

- › Extremely flexible and complex, thus limited compatibility
- › Pretty costly
- › A bit more rugged
- › Very strong in mil/aero
- › Very strong in the US market
- › Weak in other segments and in Europe
- › Potential to migrate into Europe/Asia mil markets

## xTCA

- › ATCA ideal for high-level redundant communications applications
- › ATCA continues to be successful there
- › Pretty complex and costly, but still very compatible
- ›  $\mu$ TCA(.4) found its niche in the physics market around the globe
- › Other markets only exceptionally



**THANK YOU FOR YOUR ATTENTION!**

**ANY QUESTIONS?**