Air
Land
Sea
Space
Cyberspace

Innovation. In all domains.

Middleware Transports

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Systems Need Modularity

- ## Increasing Complexity
- ## Diversity of Hardware
  - GPPs, DSPs, FPGAs
- ## Diversity of Software
  - Applications
  - Devices

Modularity can be Achieved through Partitioning

Partitioning Strategies

- **Standard Middleware**
  - World Wide Web Consortium (W3C)
    - Web Services
  - Object Management Group (OMG)
    - Data Distribution Service (DDS)
    - Common Object Request Broker Architecture (CORBA)
- **Non-Standard Middleware**
  - Role Your Own
    - C/C++ APIs
    - Berkeley Sockets

C/C++ APIs

- Advantages:
  - Good performance
  - Ease of use
- Disadvantages
  - Less modular
  - Client and server must be co-located
  - Potential side effects
  - Can be difficult to mix computer languages

Berkeley Sockets

- ## Advantages:
  - – Available on most operating systems
- ## Disadvantages:
  - – Usually requires Ethernet
  - – Programmers may need to write code to accommodate different Endian architectures
  - – Programmers may need to write code to forward inbound messages to correct destination
  - – Programmers may need to write code to serialize/deserialize some of the data types
    - • Need to be aware of how data types are serialized
    - • Different computer languages may serialize differently
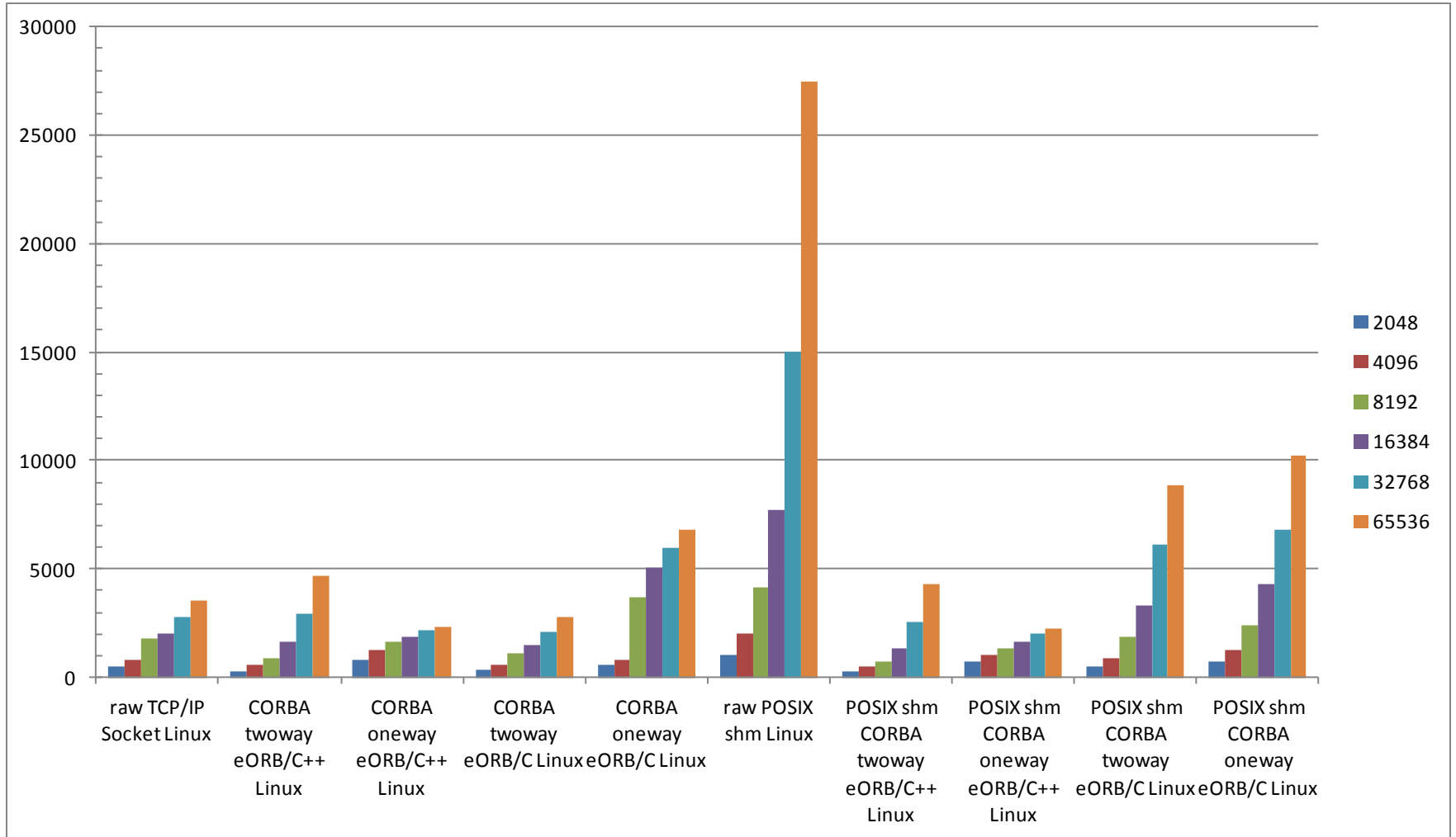
CORBA

- Example of the Object Request Broker Pattern
  - An architecture pattern
- Defines:
  - Serialization
  - Transport Mechanism
  - Other possibilities include things such as threading, message prioritization, etc.
- Advantages:
  - Language independent
  - Platform independent
  - Location independent
- Disadvantages:
  - Size
  - Performance
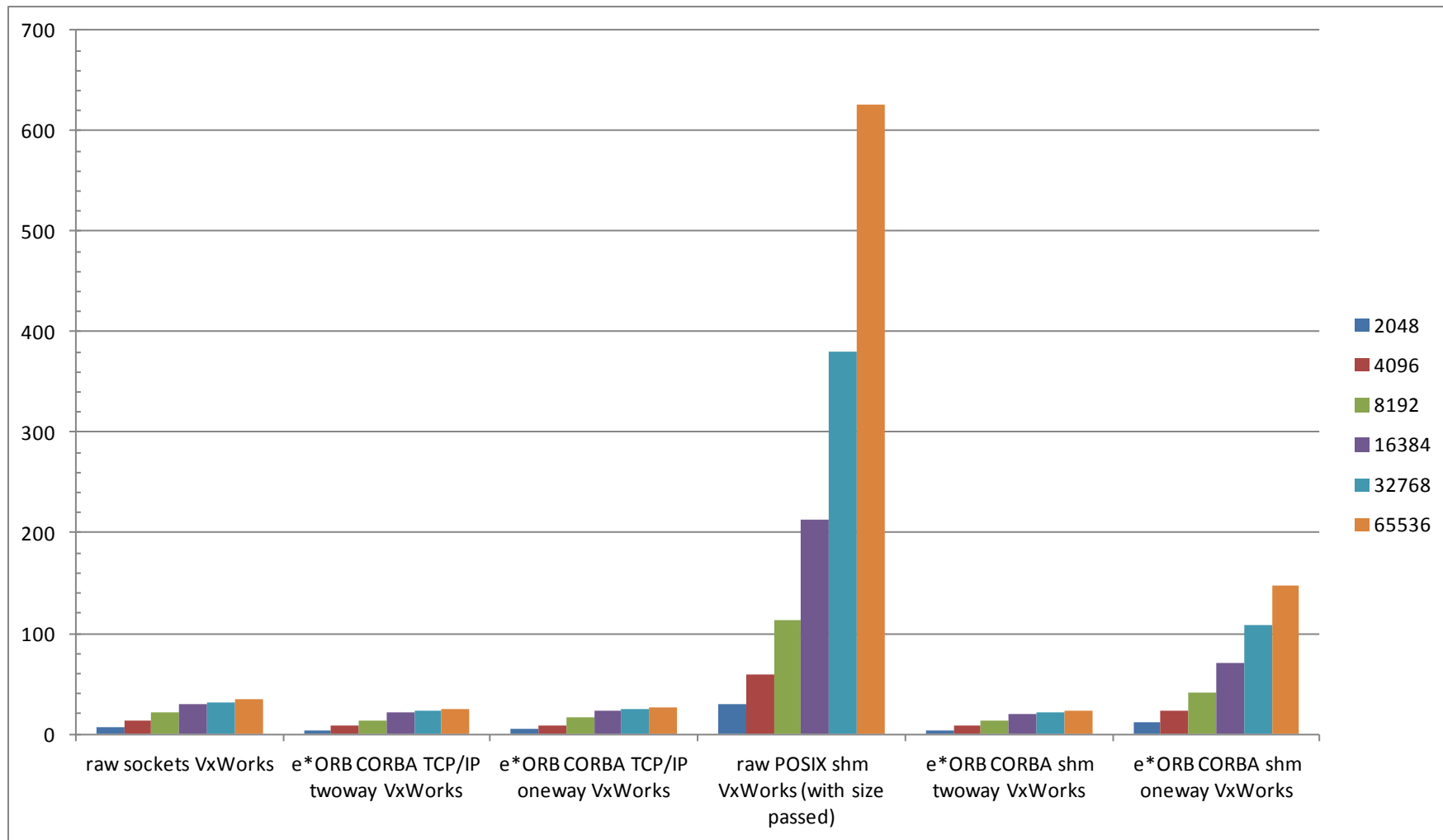
OMG Extensible Transport Framework (ETF)

- Document number: ptc/04-01-04
- Provides a way for users to supply a transport
  - Examples include shared memory and message queues
  - Could role-your-own with custom hardware
- The ETF Standard defines IDL and the expected behavior
  - Users implement the IDL methods
  - CORBA implementation calls the methods

![Raytheon]

Linux

VxWorks

Mini-Trade Study (a little subjective)

	C/C++ APIs		Sockets		Shared Memory		CORBA	
Modularity	Requires co-location	5	Endian	8	Requires co-location	6	Maximized	10
User code/debugging	Initialization done by hand	7	Initialization done by hand	7	Initialization done by hand	6	Initialization done with policies	10
Sub-Total		**12**		**15**		**12**		**20**
Size	Build only what you need	10	Requires message forwarding	9	Requires message forwarding	8	Thread and priority management	6
Performance	Function call	10	Kernel/user switching	6	Kernel/user switching	9	Buffer copies	7
Total		**32**		**31**		**32**		**33**

Summary

- Increasing complexity makes partitioning necessary
- Partitioning can be done with middleware
  - Standard
  - Non-standard
- CORBA
  - Clearly superior if size and performance are not critical
  - Otherwise can be inferior

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