PrismTech
Productivity Tools & Middleware

OMG SBC Workshop: Realizing the Vision

NEXT GENERATION SDR OPERATING ENVIRONMENTS

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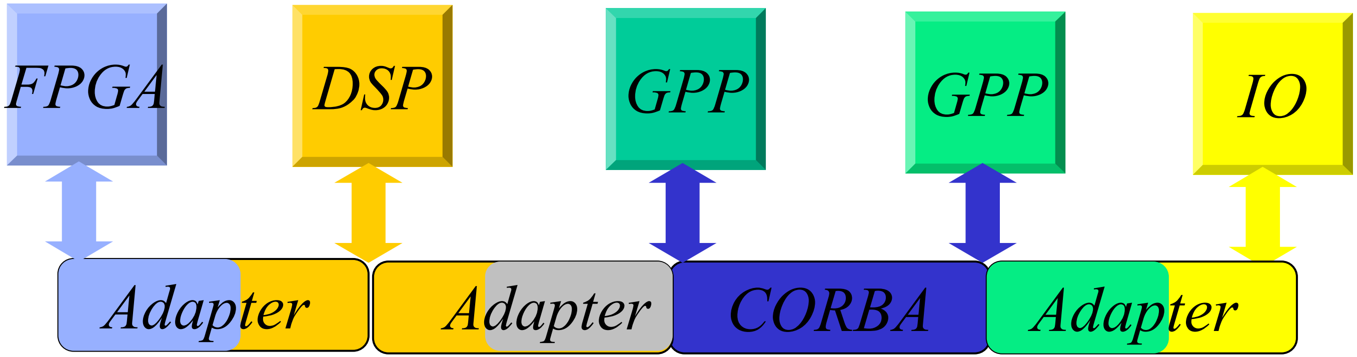
Agenda

- Past SDR Operating Environment
- Next Generation Operating Environment (OE)

Distributive Processor Communication Approaches

- There are basically two approaches
  - COTS Middleware such as CORBA
  - Adapter Design Pattern
    - Needed where COTS middleware solutions are not available
      - *Can be component specific or*
      - *Generic (usually constraining)*
    - In the past this was used for DSP and FPGA software but this approach is no longer required since CORBA COTS technology exist now
    - Still required for I/O devices such as serial.

Past Distributive Processor Communication – Adapter Illustration

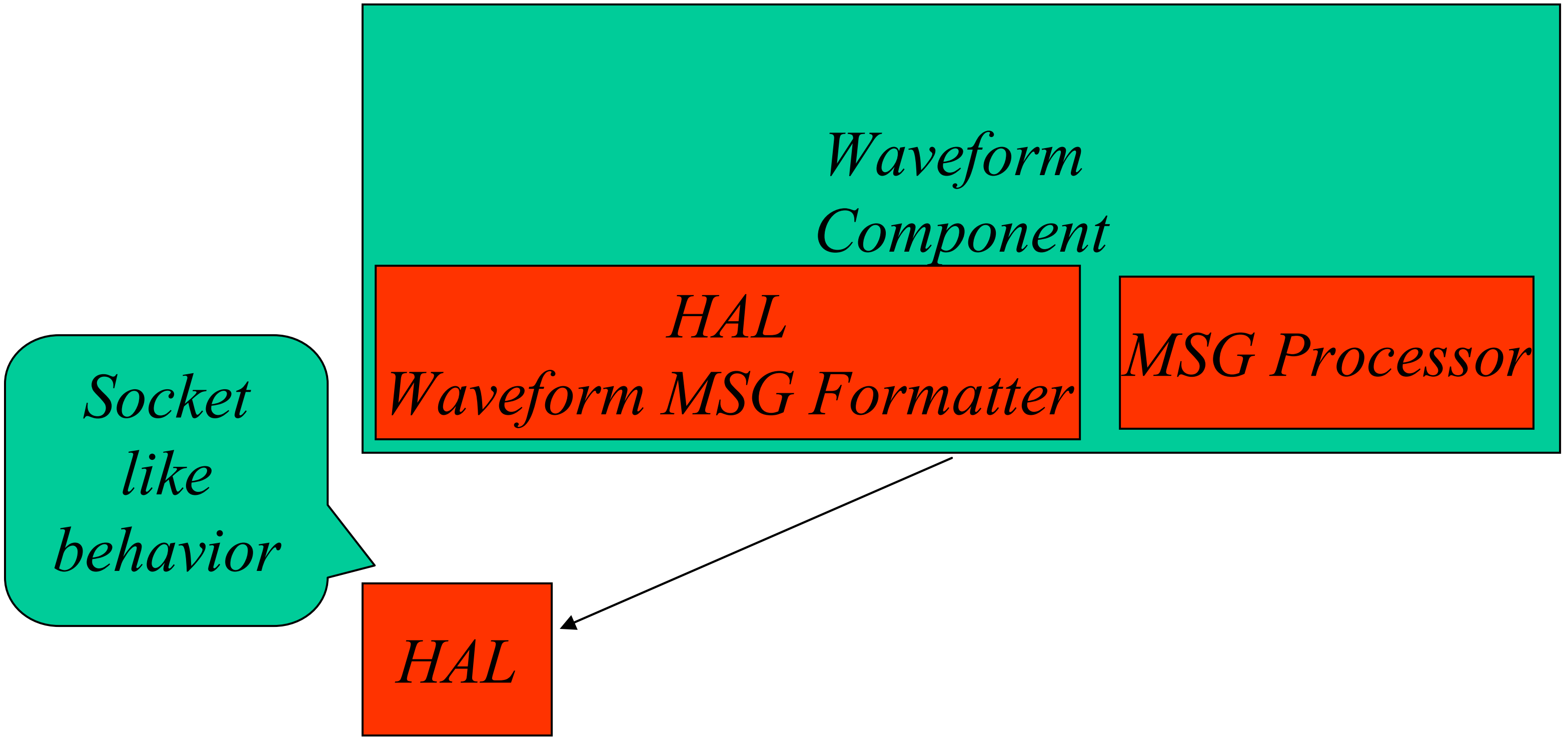


The Adapter can be part of the platform, which may constrain the interfaces, or be waveform responsibility that doesn't constrain the interfaces.

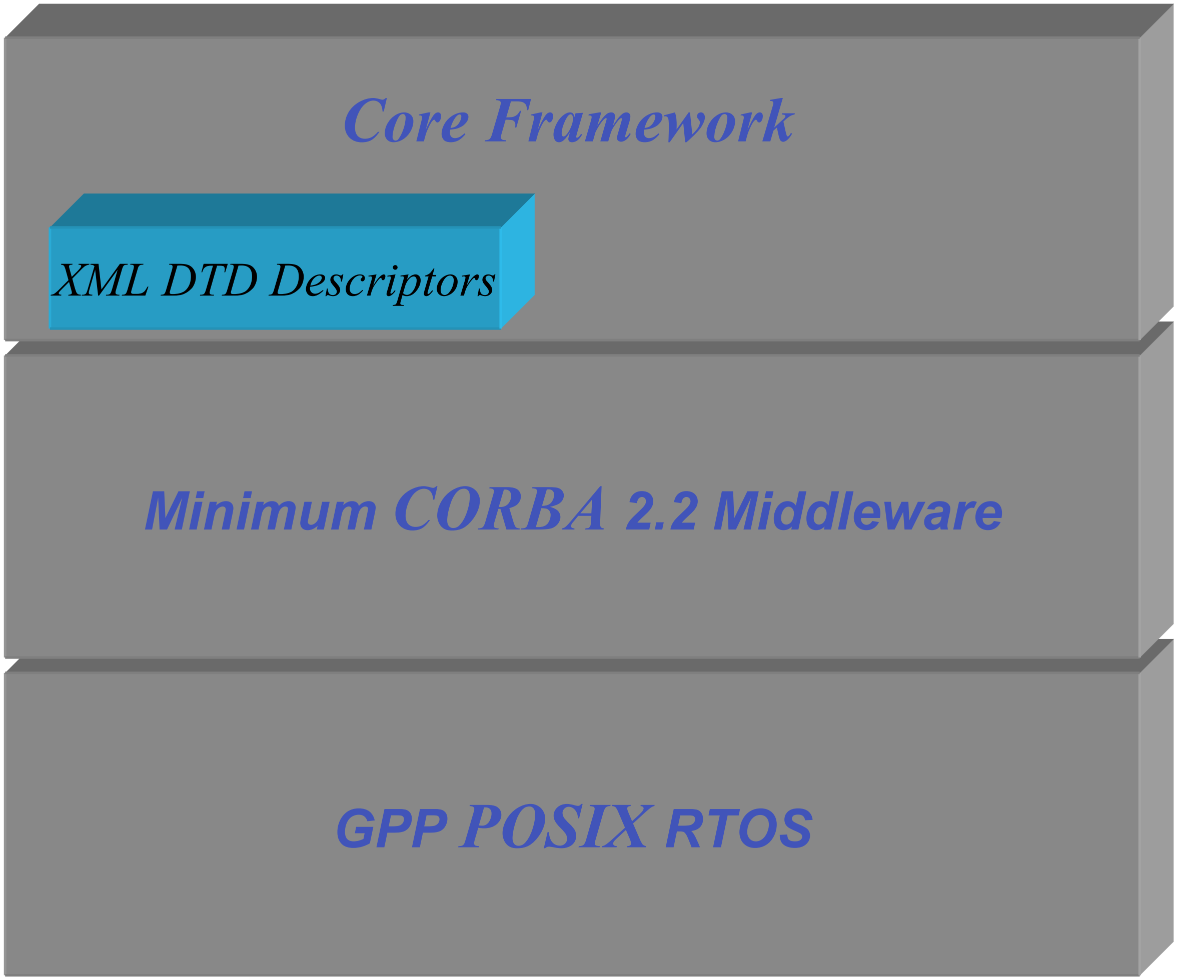
Distributive Processor Communication Approaches

- Adapter Design Pattern
  - What constitutes a good adapter design pattern?
    - The Client Component is unaware that the Server Component is a non-CORBA component.
    - The Client component port connections are at a CORBA interface level of the Server abstraction level not at a socket level where Client Component is involved with creating and processing message protocols.
  - Benefits
    - More in keeping with the SCA architecture.
    - Promotes reuse and portability of Client Component.
    - Component developer concentrates on business logic not on middleware solutions
    - Integration much easier
    - Reduce Cost and Schedule for development
  - HAL-C does not have these good adapter design pattern traits.

HAL Approach Illustration



SCA 2.2/2.2.2 Operating Environment



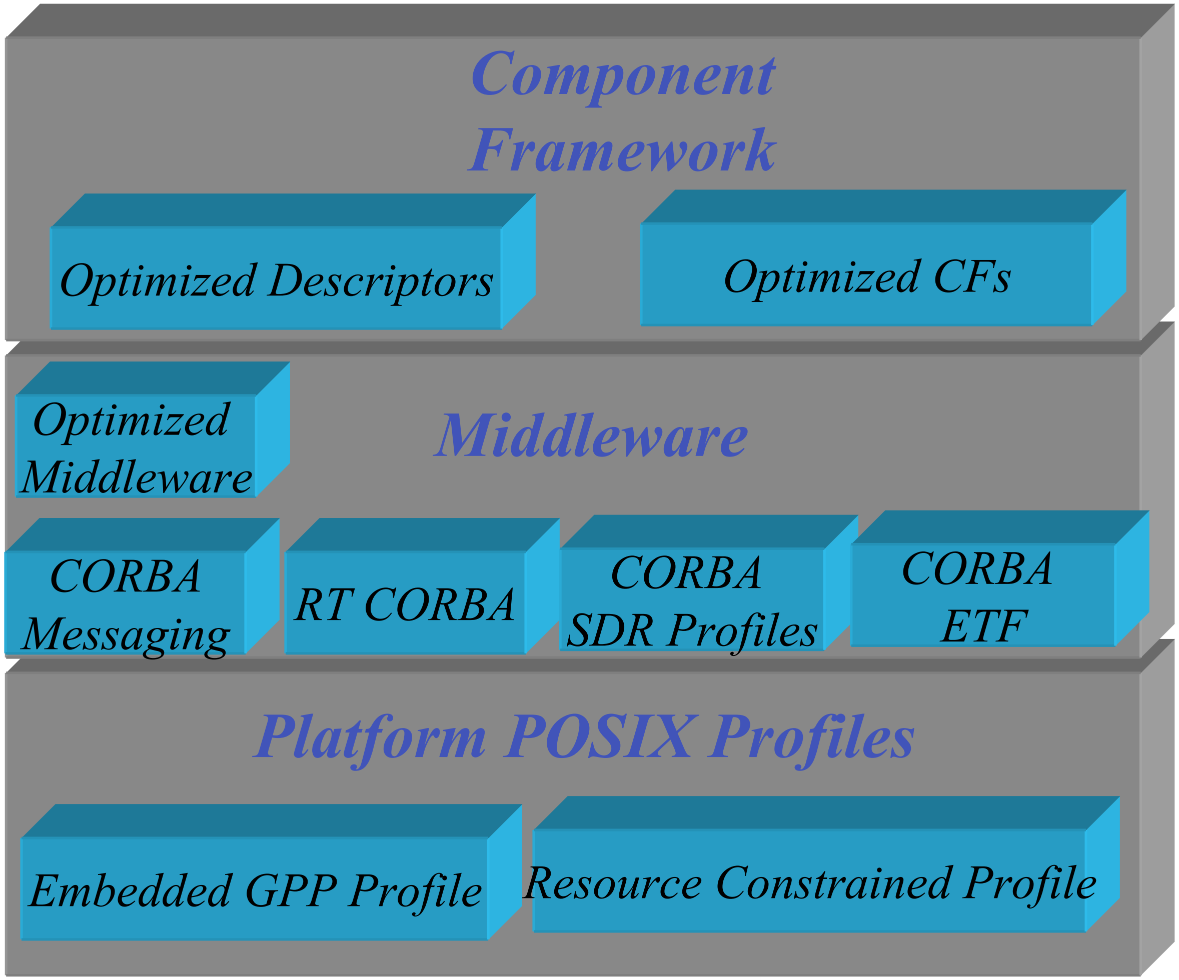
Core Framework

XML DTD Descriptors

Minimum CORBA 2.2 Middleware

GPP POSIX RTOS

Next Generation SDR Operating Environment



Next Generation SDR Operating Environment - CF

- Core Frameworks/Component Frameworks
  - Executes on Signal Processing Hardware
    - DSPs
    - FPGAs
  - Static and/or Dynamic Deployment
  - Optimized parsers and descriptors that may be other than XML.

Next Generation SDR Operating Environment – Middleware

Feature	CORBA Spec
One Way Synchronization Control and AMI	CORBA Messaging part of CORBA spec
A standard way of specifying a different transport for Performance and Latency	Extensible Transport Mechanism
RT QoS for End-To-End Predictability	Real-Time CORBA Static and Dynamic Specs
CORBA Profiles (compact and micro)	CORBA/E in place of Minimum CORBA

CORBA Messaging

- Quality of Service
  - Rebind
  - One Way Synchronous Mode
  - Request and Reply Timeout
- Asynchronous Method Invocations (including Time-Independent or “Persistent” Requests)
  - Two Way Calls by a client are treated as one way
- The specification of interoperable Routing interfaces to support the transport of requests asynchronously from the handling of their replies.

Extensible Transport Framework

- Objective – to establish a framework for plugging in transports in an ORB with sufficient predictability in order to support Distributed Real-Time & Embedded (DRE) systems
- WHY – IIOP (GIOP over TCP/IP) enables reliable remote messaging, however TCP/IP introduces unpredictable latencies unsuitable for many real-time systems
- Provides a standard set of interfaces by which a ORB transport plug-in can implemented
  - Portability of application code.

RT CORBA

- RT CORBA extensions add several new modules and interfaces for RT QoS to achieve end-to-end predictability and control over the management of resources
  - To produce deterministic software
  - Improve software development quality, productivity, adaptability, assurability, and integration
  - To Prioritize Component’s Port connections
- Real-time QoS should not be hard coded in waveform code.
  - This is important as waveforms are integrated onto other platforms.

CORBA/E

- CORBA/e is designed to meet the most demanding requirements of performance based embedded applications without forfeiting the interoperability, portability, and platform independence that CORBA has built its reputation on.
- CORBA/e was designed to dramatically minimize the footprint and overhead of typical middleware, shedding much of the dynamic and high resource consuming aspects of CORBA facilitating implementations that can meet the stringent requirements of Real-Time embedded computing.

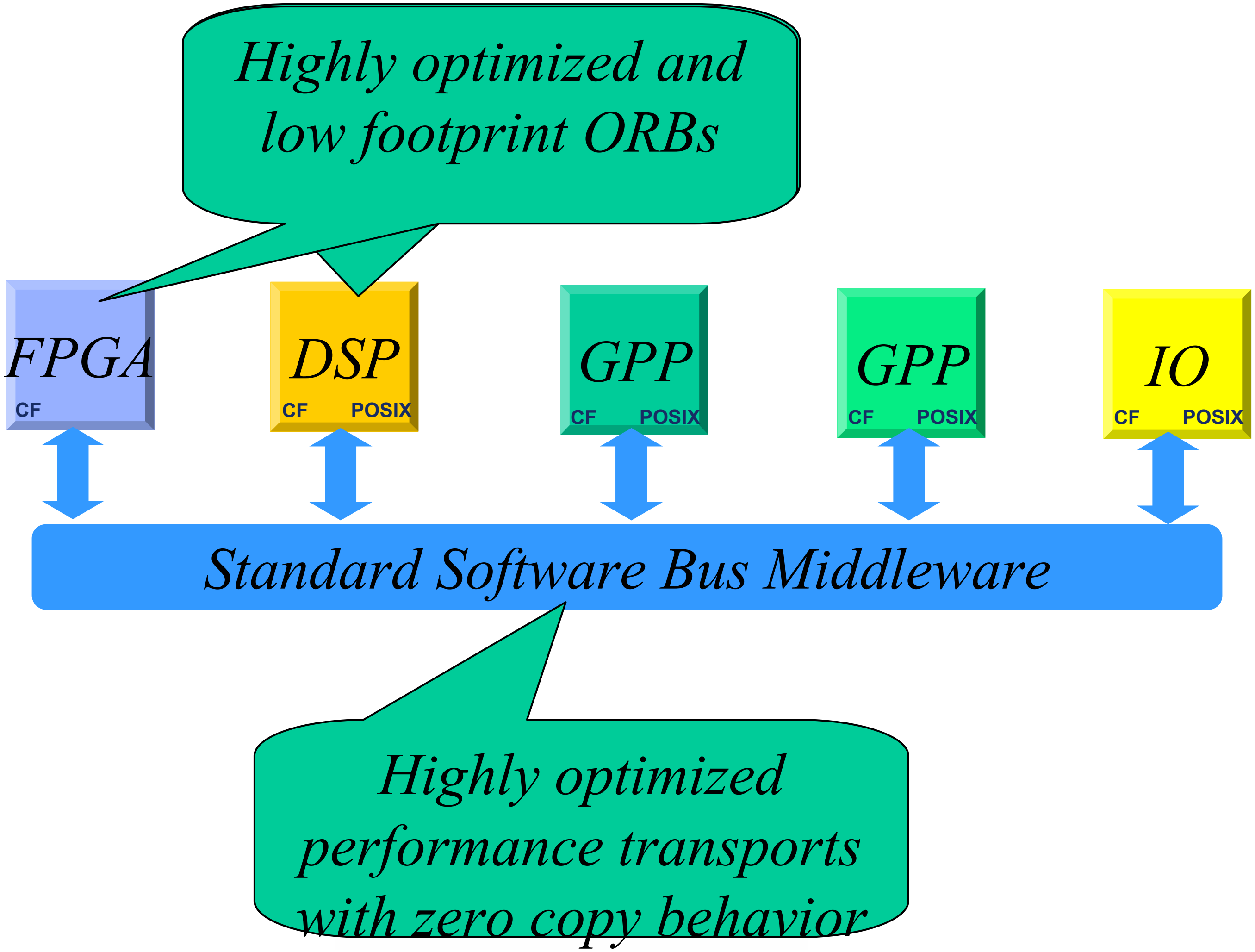
CORBA/E Profiles

- The CORBA/e Compact Profile is targeted to applications or portions of applications that will be executing on an embedded processor with constrained resources but at the same time requiring predictable Real-Time behavior.
  - Assumed resources include those that are typically available in a 32-bit micro-processor running any one of the available Real-Time Operating Systems (RTOSes).
  - Assumed application requirements are limited to statically defined interfaces, interactions, and scheduling. While resource constrained, these systems typically have enough capability to support sophisticated embedded applications, such as signal or image processing, with Real-Time predictability requirements.
- The CORBA/e Micro Profile is targeted to applications executing on a "deeply embedded" processor with severely constrained resources, e.g. those in a mobile device.
  - Assumed resources are limited to those that are typically available on a low-power microprocessor or high-end Digital Signal Processor (DSP).
  - Assumed application requirements are limited to statically defined interfaces, interactions, and scheduling.

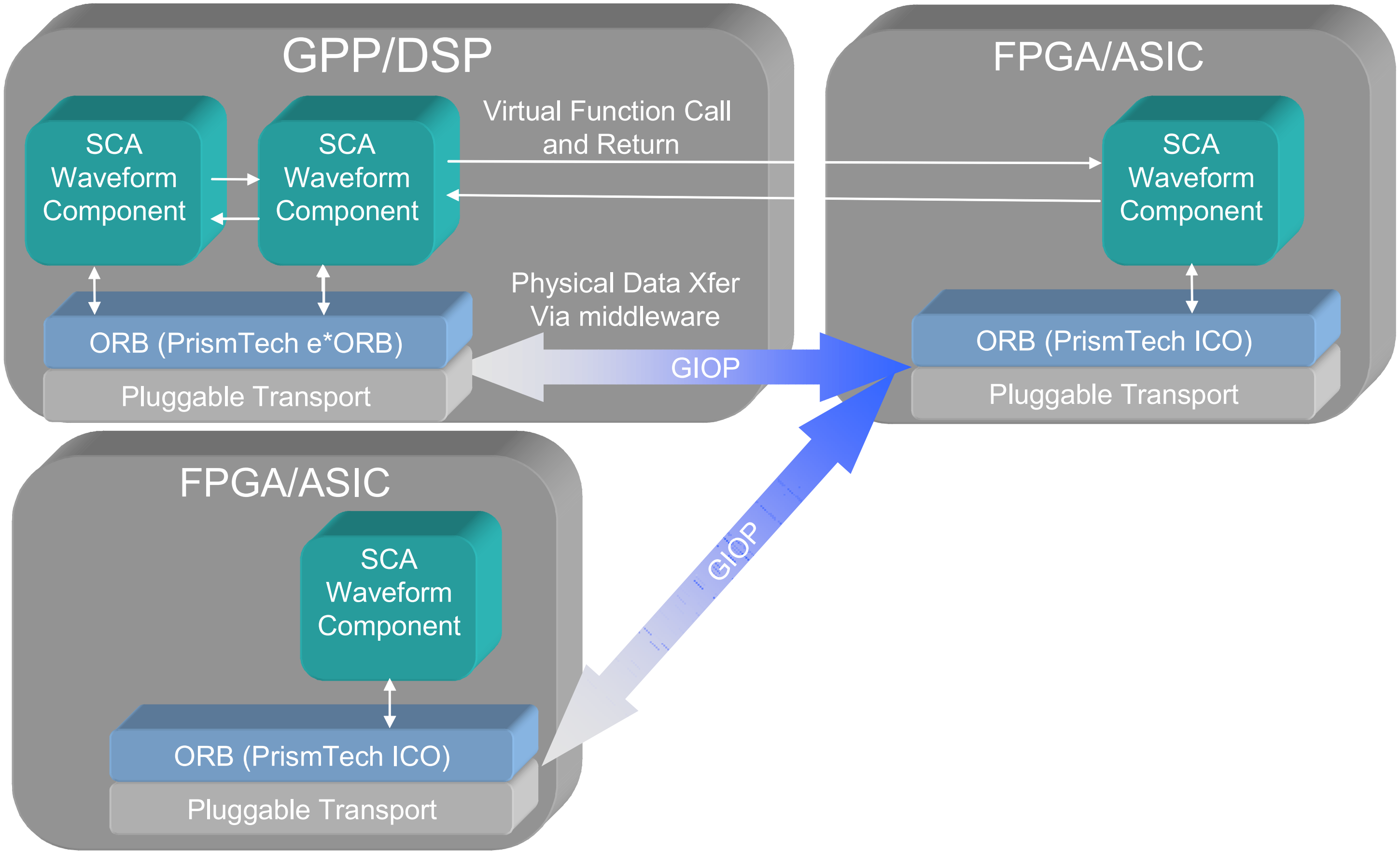
Next Generation SDR Operating Environment – POSIX Profiles

- POSIX Profiles Specification Volume
  - Two Profiles are defined which are a subset of the Real-time Controller System Profile (PSE52) Standardized Application Environment Profile - POSIX® Realtime Application Support (AEP), IEEE Std 1003.13-2003
    - The application environment profile (AEP), which is for constrained embedded general purpose processing, is the preferred profile for embedded processing and its utilization is encouraged for all processing environments.
    - The lightweight application environment profile (LwAEP) is more constrained than the AEP and is targeted towards environments with limited computing support such as embedded processors like Digital Signal Processors (DSPs) and micro-controllers.

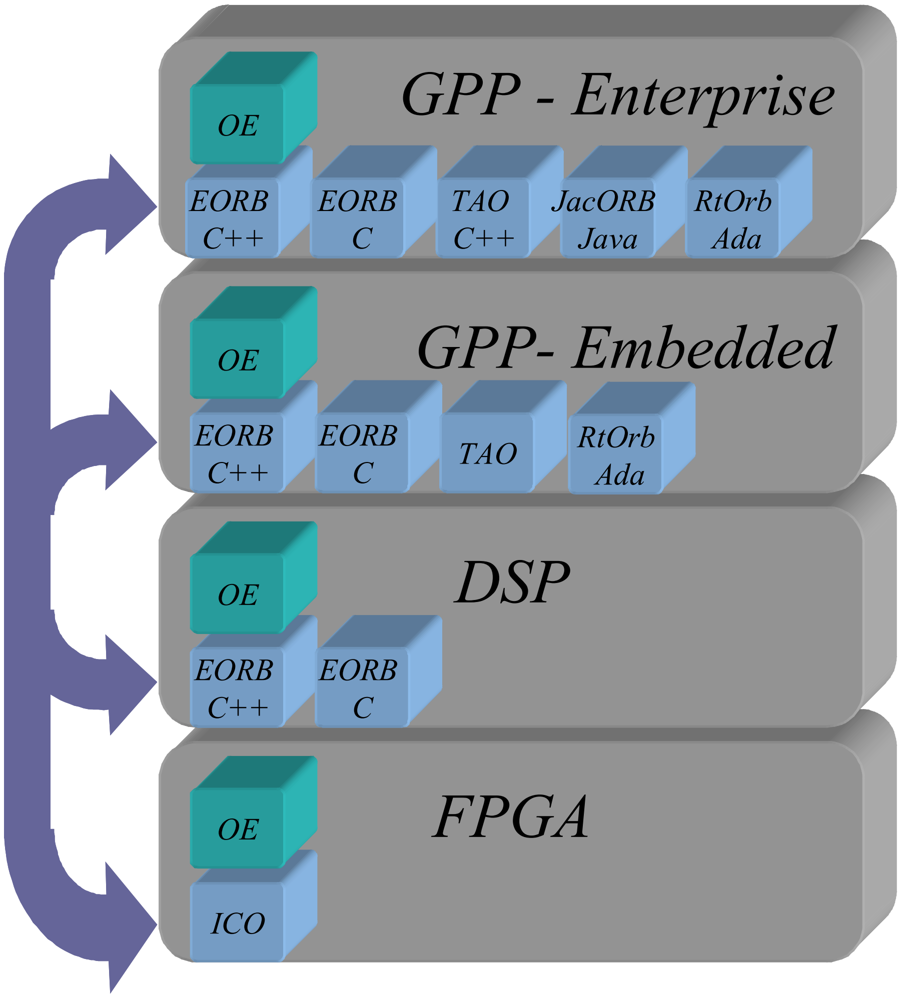
Next Generation OE


Highly optimized and low footprint ORBs
FPGA
CF
DSP
CF
POSIX
GPP
CF
POSIX
GPP
CF
POSIX
IO
CF
POSIX
Standard Software Bus Middleware
Highly optimized performance transports with zero copy behavior

Next Generation OE – Configurations Illustration



Next Generation OE Products Availability Illustration



Conclusion

- To reap the benefits afforded by SDR architectures like the OMG SWRadio Component Framework next generation OEs must:
  - Support the architecture on all physical processing elements
  - Deal with resource constrained environments found in complex SDR systems
- Technologies to support this vision exist today
- In essence, make the technology fit vision not the other way around