# Real Time CORBA-MMS for Embbeded Systems

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Our work is an on-going project at CEDRIC, the computer science lab of CNAM. Our goal is to achieve a real-time messaging industrial service for embedded and real-time systems. Our framework takes its sources in two standards: ISO-MMS (Manufacturing Message Specification from OSI) [VAL92] and IEC-TASE.2 (Telecontrol Application Service Element version 2 from IEC) [IEC96a][IEC96b], also called ICCP (Inter-Control Center Protocol). We translate their most interesting features for embedded systems to deliver a real-time object oriented industrial messaging service on top of CORBA. Our work respects the overall design of both standards, the functionalities we offer are equivalent. Our result targets applications from manufacturing, ground control systems for space and aircraft, process control, transportation systems… all domains where ISO-MMS was targeted for.

MMS is not an e-mail service for industrial devices. It is not an Instant Message facility as Jabber [JAB00] and it is not a message service as Java Messaging Service [SUN00]. MMS is an application layer protocol from OSI. MMS specifies an abstract representation of a device, Virtual Manufacturing Device (VMD). VMDs store and handle 12 abstractions representing the resources of a real device, the most important of them being the Domain, the Program Invocation and the Variable abstractions. Communication assumed by the MMS protocol is message oriented although the most often used communication scheme is a synchronous request/reply interaction (called a confirmed service) that provides a kind of client/server model between devices and users' applications. The server role is essentially associated with the device, and the client role is dedicated to remote users' programs. MMS also uses a few one-way interactions (called unconfirmed services): they allow un-sollicited devices to send asynchronous alarms and status reports to clients. Same industrial messaging services exist in standard fieldbus systems as PROFIBUS [PRO00] or WorldFIP [WOR00] or proprietary fieldbuses.

The TASE.2 protocol runs over MMS. TASE.2 is client/server based, as defined in MMS, and provides its own object model. TASE.2 objects and services are mapped onto MMS abstractions and services. TASE.2 functions are separated in nine conformance blocks. Blocks 1,2 and 5 deal with real-time based capabilities. Block 1 defines periodic report based services. It is mandatory. Block 2 is related to on-change report based services. Block 5 deals with remote control of real devices. Data structures associated with these services are represented through Variables, Lists of Variables, Transfer Descriptors associated to list of variables. Four semantics are provided to exchange lists of variables between control centers: "once" (immediate client/server request), "periodic" (periodic transfer), "exception"(state change based transfer), "event" (event condition based transfer). This framework extends MMS with real-time capabilities. We believe that it is convenient for embedded systems.

MMS has been adapted to CORBA. We objectified MMS to be compatible with the CORBA object model, services have been transformed in method invocations. A first prototype has been released in C++, using the ORBCOOL over the ChorusOS micro-kernel from Sun [GUY97]. We expect that this work could use minimum CORBA. A Java based prototype that uses ORBacus from OOC or the Jonathan ORB [DUM98], has been provided, it is able to control remotely a CORBA based Numerical Command Machine [GRE99]. Real-time communication enhancements have been tackled with ATM and Linux using the extensible protocol framework of Jonathan [SEI99].

Currently, we are extending the previous prototype called CORBA-MMS with the real-time features issued from TASE.2 blocks 1, 2 and 5. We expect to run the resulting real-time industrial messaging service on top of a RT-CORBA conformant ORB. The program invocation abstraction could benefit from the distributable thread specified in the OMG's distributed scheduling proposal [OMG00].

## References


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