

Software Design & Analysis

Engr. Abdul-Rahman Mahmood

DPM, MCP, QMR(ISO9001:2000)

 armahmood786@yahoo.com


 alphapeeler.sf.net/pubkeys/pkey.htm

 pk.linkedin.com/in/armahmood

 www.twitter.com/alphapeeler

 www.facebook.com/alphapeeler

 abdulmahmood-sss  alphasecure

 armahmood786@hotmail.com

 <http://alphapeeler.sf.net/me>

 alphasecure@gmail.com

 <http://alphapeeler.sourceforge.net>

 <http://alphapeeler.tumblr.com>

 armahmood786@jabber.org

 alphapeeler@aim.com

 mahmood_cubix  48660186

 alphapeeler@icloud.com

 <http://alphapeeler.sf.net/acms/>

Advanced Dynamic Modeling Illustrated by Real-Time Systems

Real-Time System

What Is a Real-Time System?

- system concerned with performance, scheduling, and timing.
- Even a simple Internet application has real-time elements with performance over a distributed network.
- Any time a system must handle external events within constrained time limits, execution is concurrent, or the performance of the system needs to be “fast,” you can benefit from real-time modeling features.

Attributes of a Real-Time System

- **Timeliness is important**
- **It is reactive.**
- **It contains concurrently executing control processes, where different parts of the software run in parallel.**
- **It has very high requirements in most of the non-function-related areas such as reliability, fault tolerance, and performance.**
- **It is not deterministic.**

Embedded system & RTOS

- The system often works closely with specialized hardware and has to handle low-level interrupts and hardware interfaces, or ports. A system that involves tightly integrated specialized hardware and software is
- called an *embedded system*. Embedded systems can be found in cars, consumer electronics, manufacturing machines, and many other places. An embedded
- system often uses a small real-time operating system that uses limited memory.
- An embedded system must be fast enough to control its hardware and to handle all the events, even in a worst-case situation when everything happens at once.

Types of Real-Time Systems

- Real-time systems are often divided into hard and soft categories. In a hard real-time system, a late (or incorrect) response is considered an unacceptable error that can result in loss of life. Examples of hard real-time systems are airplane control software, life surveillance systems, battlefield target control, and automatic train control systems. Soft real-time systems can accept a late response occasionally, for instance, in a digital telephone system: it may take a long time to connect a call, or the connection may fail; neither scenario is considered a serious or dangerous error, but they are situations the company wants to avoid. Real-time systems, then, require excellent design.

Concepts in UML for Real-Time Systems

- The Object Management Group (OMG) has a set of standard extensions for real-time systems called the profile for schedulability, performance, and time. This can help with advanced real-time modeling concepts, such as those involving complex latency and relative time.
- **Profile for schedulability, performance, and time.**
- **<https://www.omg.org/spec/SPTP/1.1/PDF>**

Further Readings

- **Ch 6. Advanced Dynamic Modeling Illustrated by Real-Time Systems.**
Page 192 – 205 & Fig 6.1 - 6.4
- Book URL :
https://www.ecotec.edu.ec/documentacion/investigaciones/docentes_y_directivos/articulos/6008_TRECALDE_00278.pdf
- Theory topics on Realtime UML :
 1. Concepts in UML for Real-Time Systems
 2. Active Class / Object
 3. Communication (Asynchronous / Synchronous)
 4. Events / Triggers
 5. Signals (Change / Signal / Call / Time trigger)
 6. Messages (Synchronous, Reply, Create, Asynchronous, Lost, Found)
 7. Synchronization and Concurrency
 8. Fault Tolerance
 9. Implementation in Java