H/2 DLC Protocol in Hard Real Time Systems

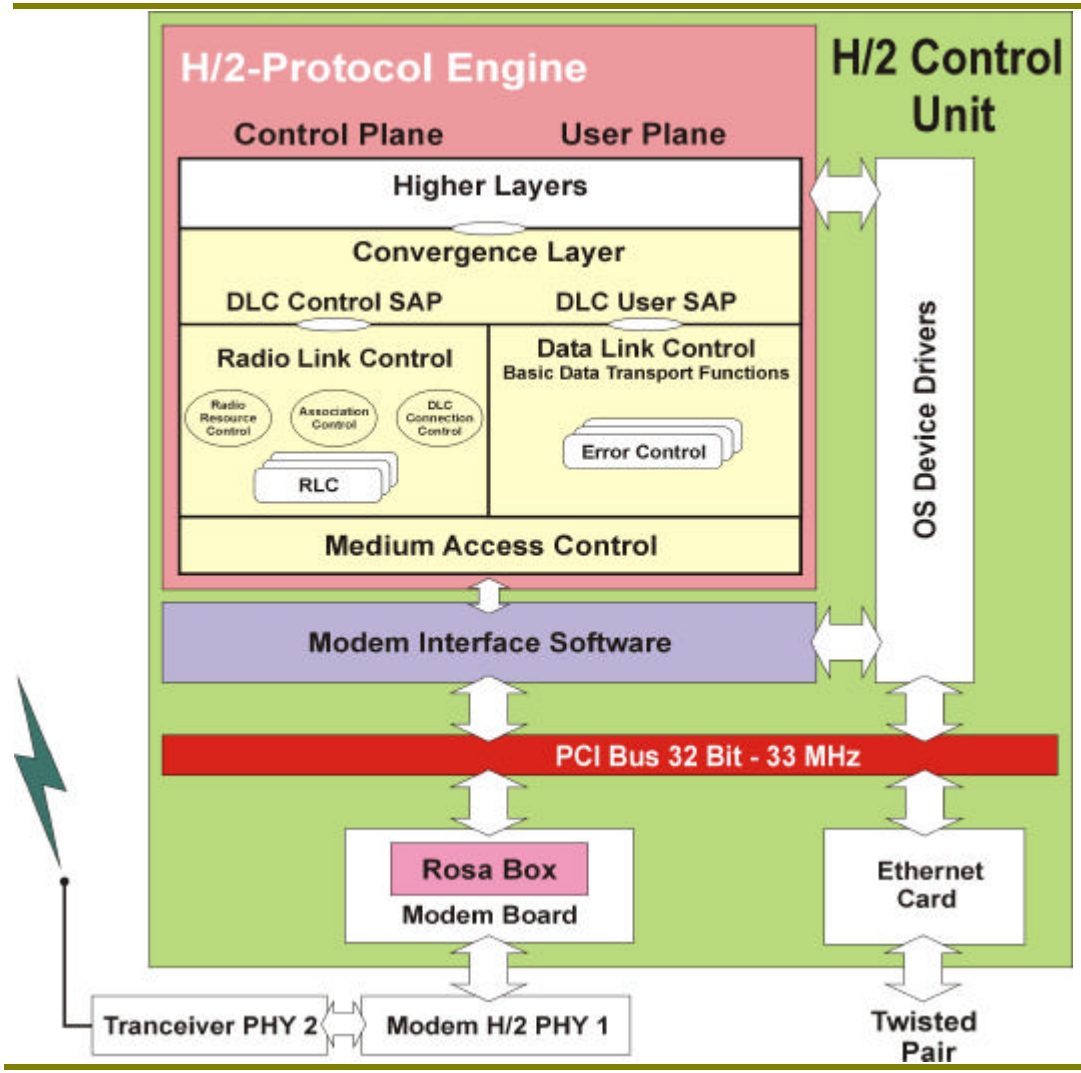
H. Wijaya[23], N. Esseling[2], O. Klein[2], W. Zirwas[1], Hui Li[1], J. M. Eichinger[1], A. Vidal[2]

[1] = Siemens AG, [2] = ComNets, RWTH Aachen, [3] = AixCom GmbH GERMANY

COVERAGE

- Initiated by Siemens AG
- To observe and to develop Multi-Hop networks
- The testbed development is shared among TU Hamburg-Harburg, IAF and TU-Dresden, AixCom and RWTH Aachen (ComNets)
- To analyse and to optimise new algorithms e.g. for channel estimation, Radio Resource Management, Vertical and Horizontal Handover procedures
- To develop a Multi-Hop capability for H/2 using “Forwarder” concepts

Testbed Architecture



- The H/2 Data Link Control Protocol (DLC) is formally specified using Specification and Description Language (SDL)
- Modem Interface Software (MIS) is responsible to handle the IRQs and Memory Mapping
- Rosa Box is responsible for Tx and Rx timing / synchronization purpose
- Time critical processes

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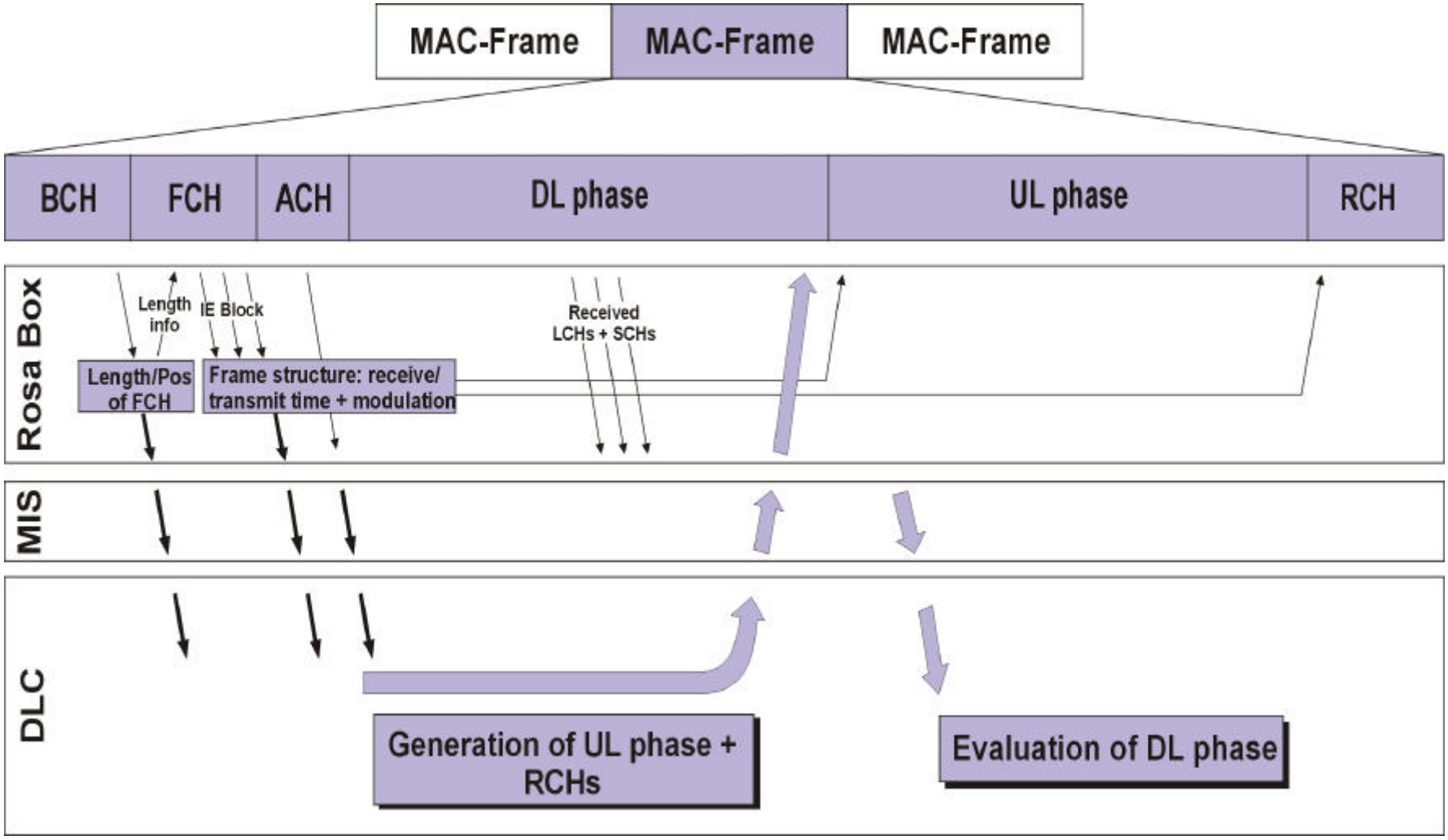
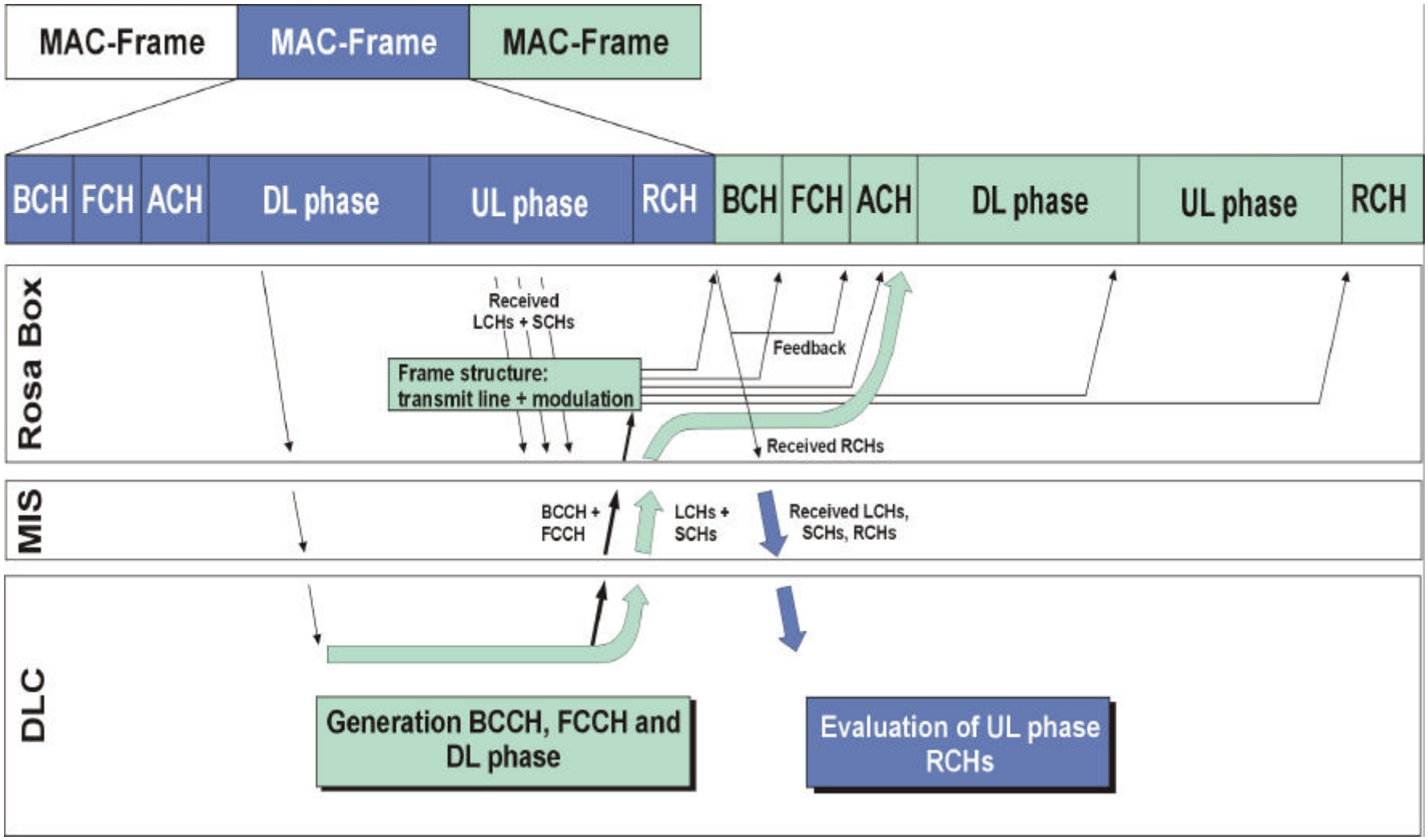
Timing in Mobile Station MAC



Timing in Acces Point MAC



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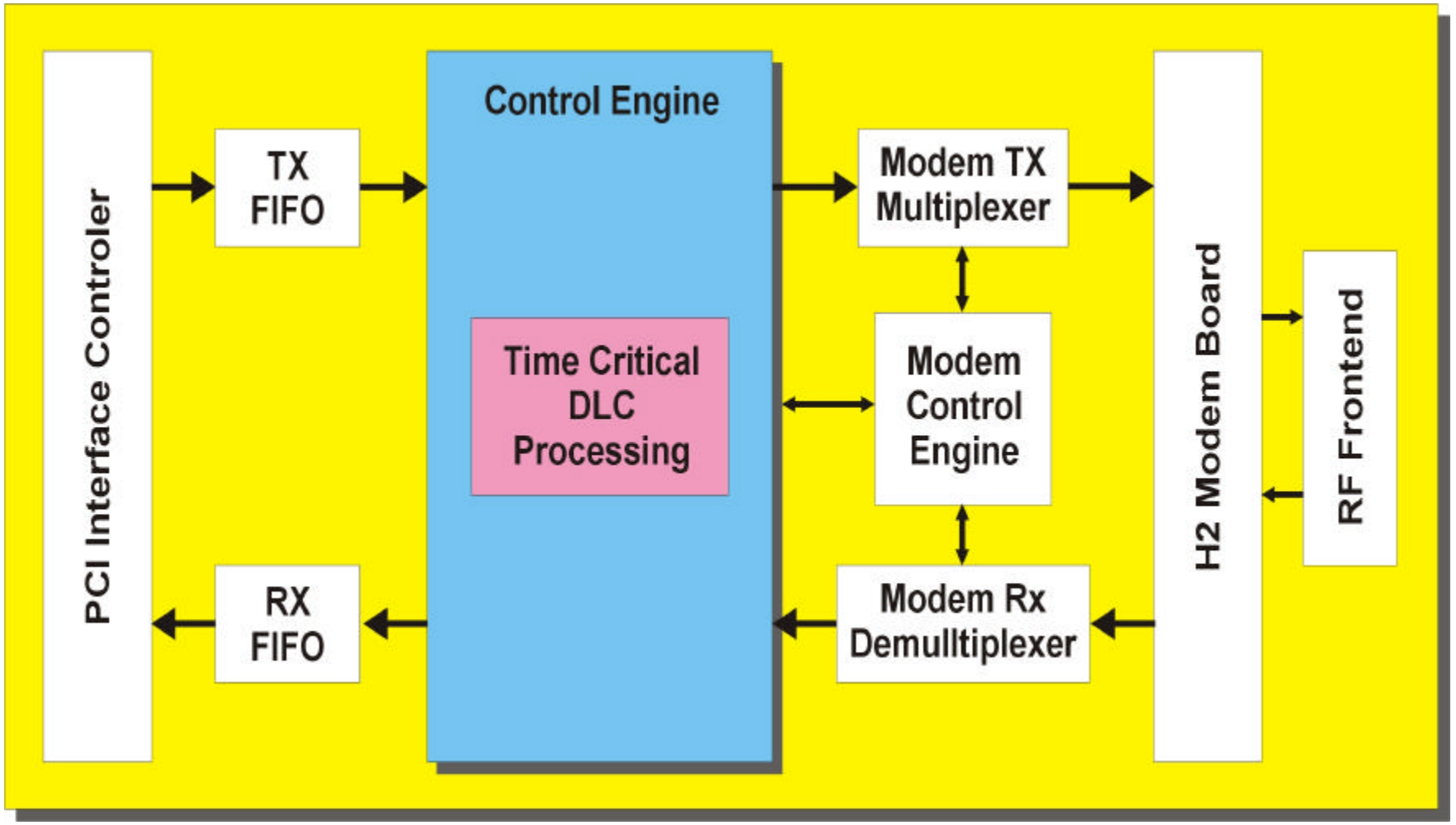
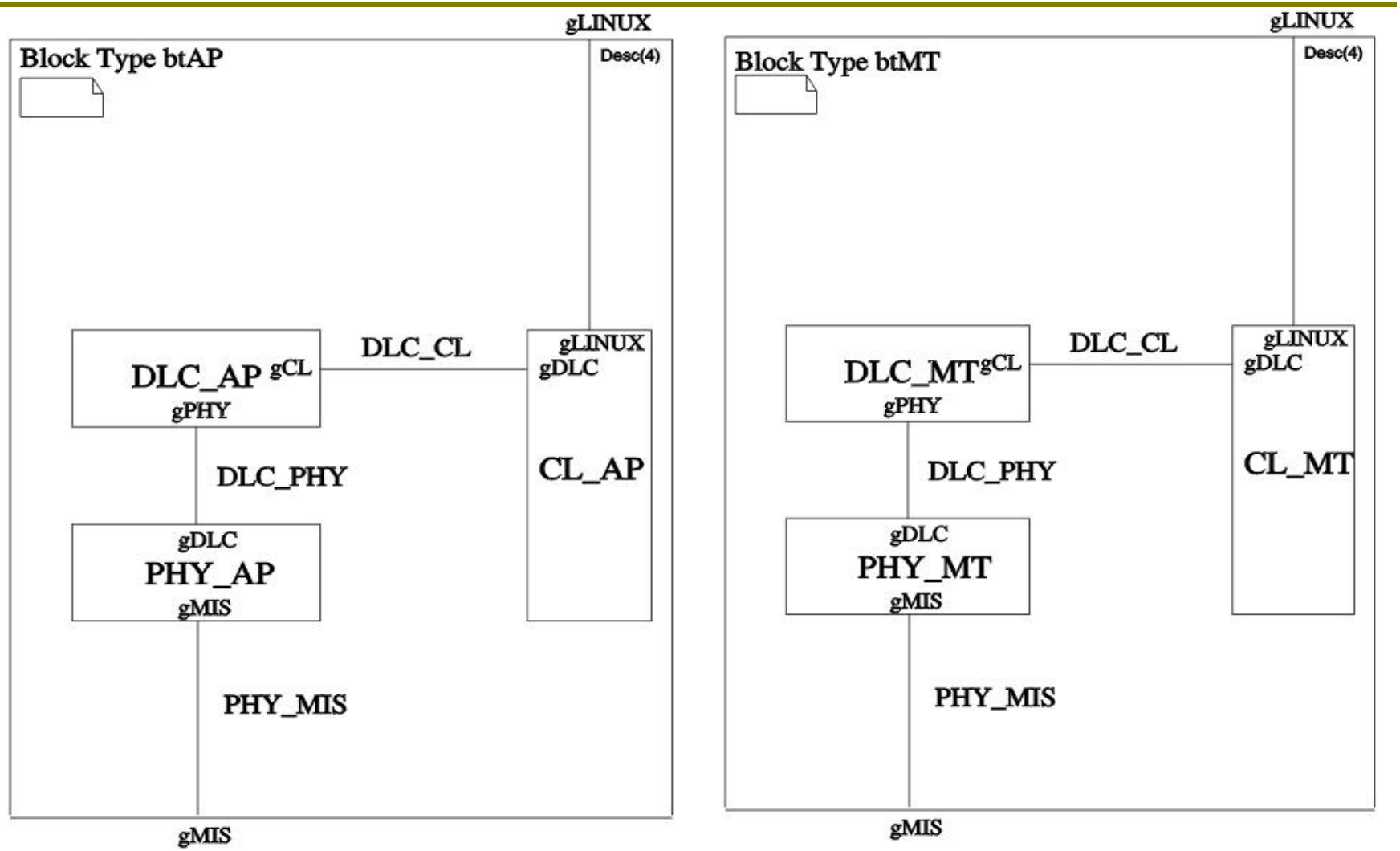
Time Critical DLC Processing



H/2 DLC Specification in SDL



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Problems in DLC Development

SDL is easy and good to use for specifying communication protocols but ...

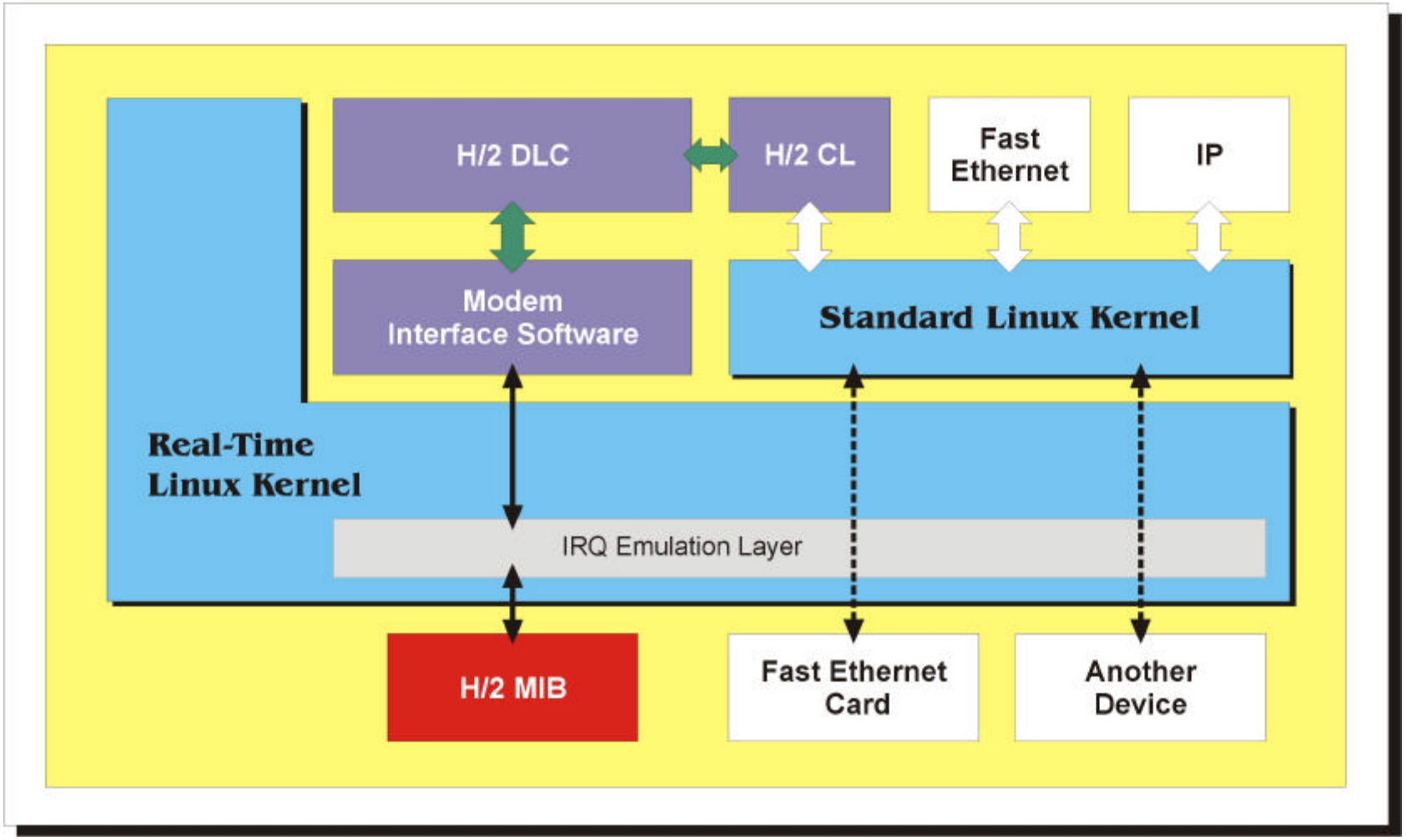
- The execution time of „standard“ SDL specification is very slow
  - ⇨ SDL is not best suited for Hard Real Time system !!
- It is very difficult to program an interface that works well with both SDL data structures and hardware data structures (MIS)
  - ⇨ SDL cannot provide a good Software Abstraction Level for Modem Interface Software (MIS) !!
- The „standard“ SDL executable from SDT Telelogic Tau is a user application
  - ⇨ SDL introduces extremely high delay and the concept of device driver programming is violated !!

DLC Development in RT System

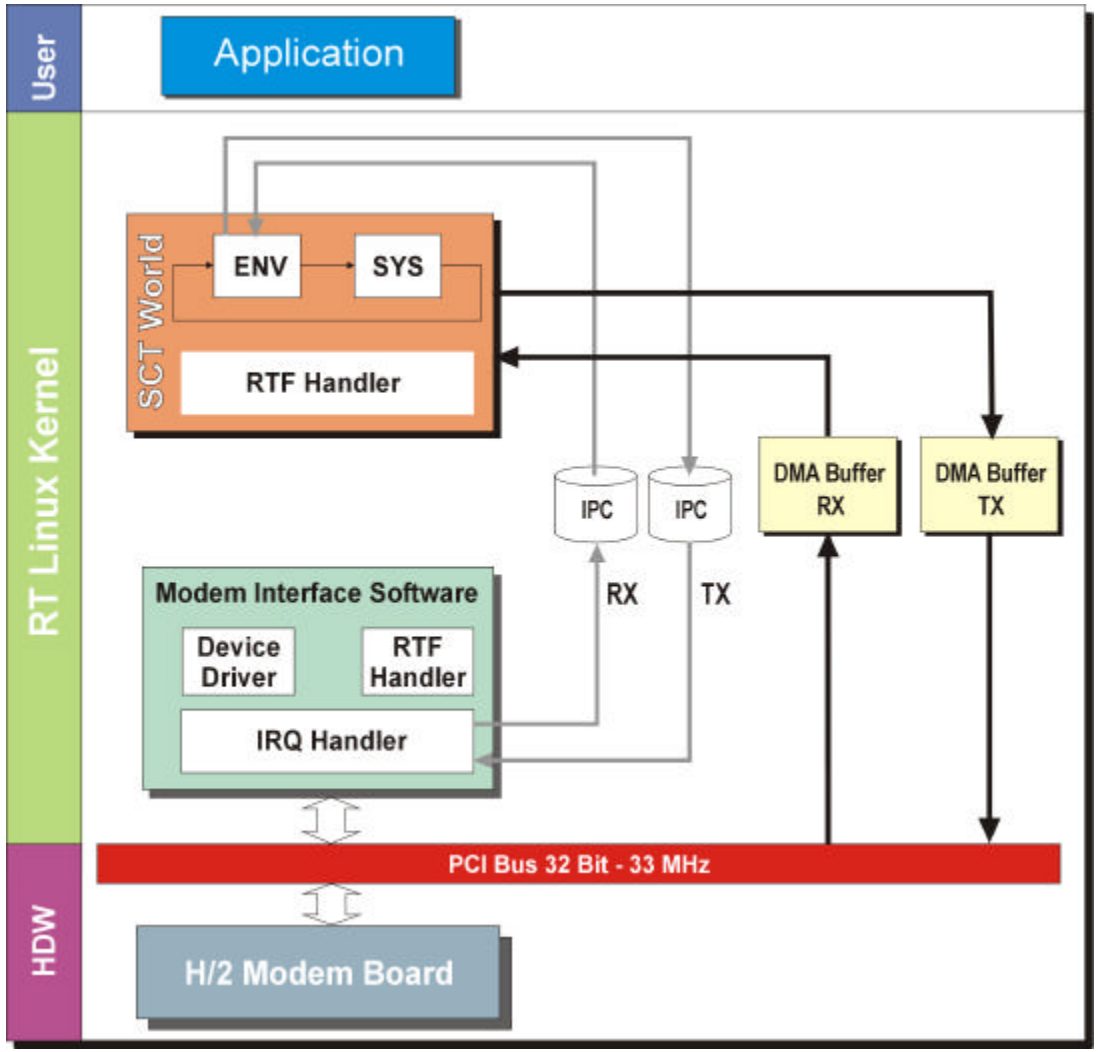
Therefore

- Introduce C pointer into the SDL specification
- Introduce C data structures which work perfectly in both SDL and hardware interface environments (MIS)
- Linux supports only „Round Robin“ scheduling
  - ⇨ SDL protocol has the same priority as the mouse protocol
- Real Time Linux supports „Priority“ Scheduling
  - ⇨ Development of some new SDL Kernels which enable the SDL specification to run as Real Time Linux module
  - ⇨ Compile and link the SDL specification and the SDL Kernel together as RT Linux Module and assign a high priority to it

H2 Device Driver



SDL in Real Time Kernel
(Soft Real Time approach)



- MIS intercepts IRQs from H/2 modem board and writes a message into the IPC queue
- The SDL Kernel (SCT World) wakes up periodically to poll the ENV
- The ENVironment (ENV) checks the IPC queue if there is a message
- Then the ENV will contact SDL (Sys) after processing the message from IPC queue

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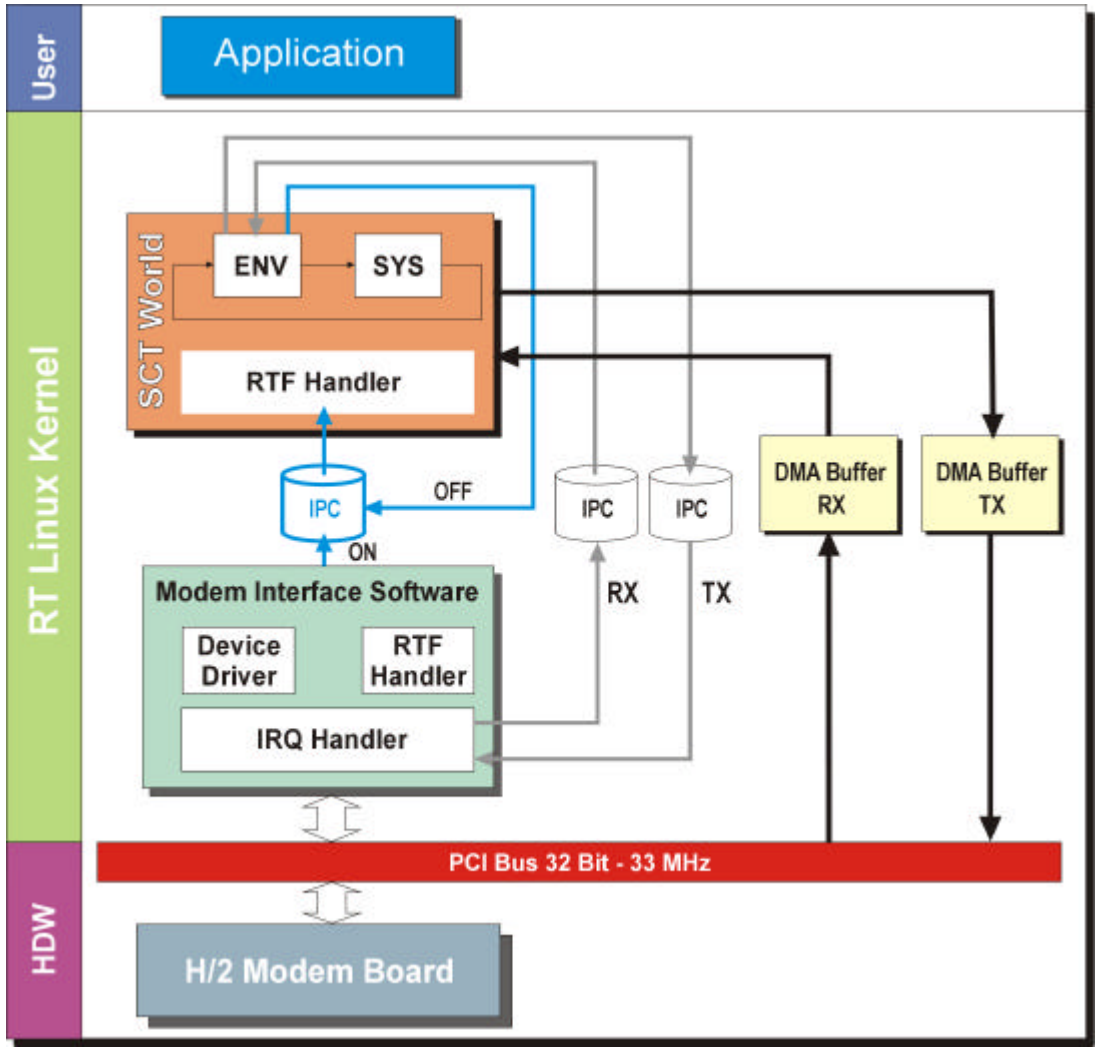
SDL in Real Time Kernel
(Hard Real Time approach)



- MIS intercepts IRQs and triggers the SDL Kernel on by sending „ON“ signal through IPC and writes a message into the IPC queue
- The ENV checks the IPC queue if there is a message
- Then the ENV will contact SDL (Sys) after processing the message from IPC queue
- The ENV, triggers the SDT Kernel off by sending „OFF“ signal through IPC

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Summary

- The objectives of COVERAGE project
- To observe and to develop Multi-Hop networks
- Multi-Hop for H/2 using “Forwarder” concepts
- Development of H/2 Data Link Control (DLC) in SDL
- Development of some new Soft and Hard Real Time SDL Kernels
- Development of Hard Real Time H/2 device driver