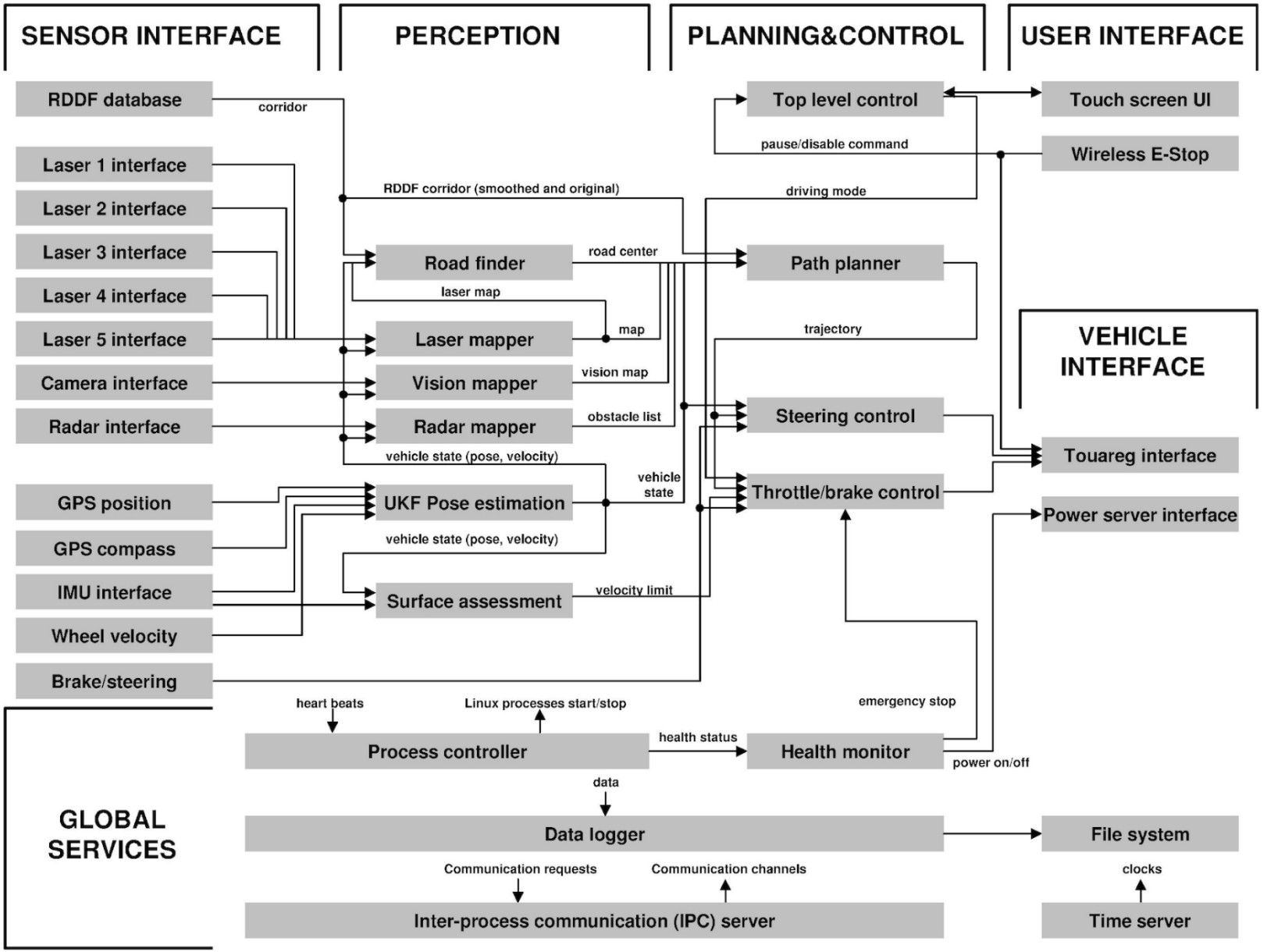
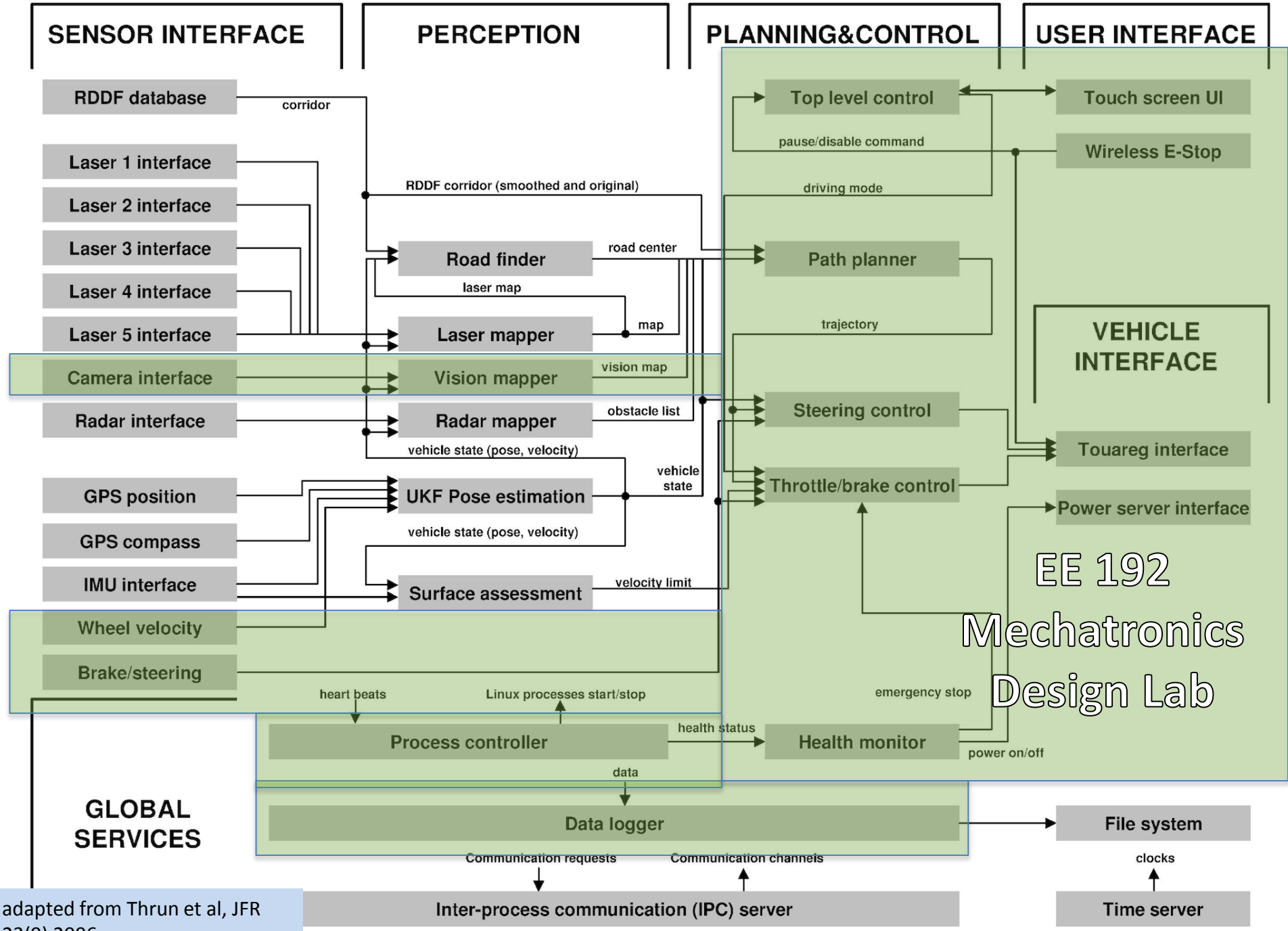
EECS192 Lecture 1
Jan. 20, 2016

- Project Description
- Autonomous system example
- Course Organization
- ARM Cortex M0 overview

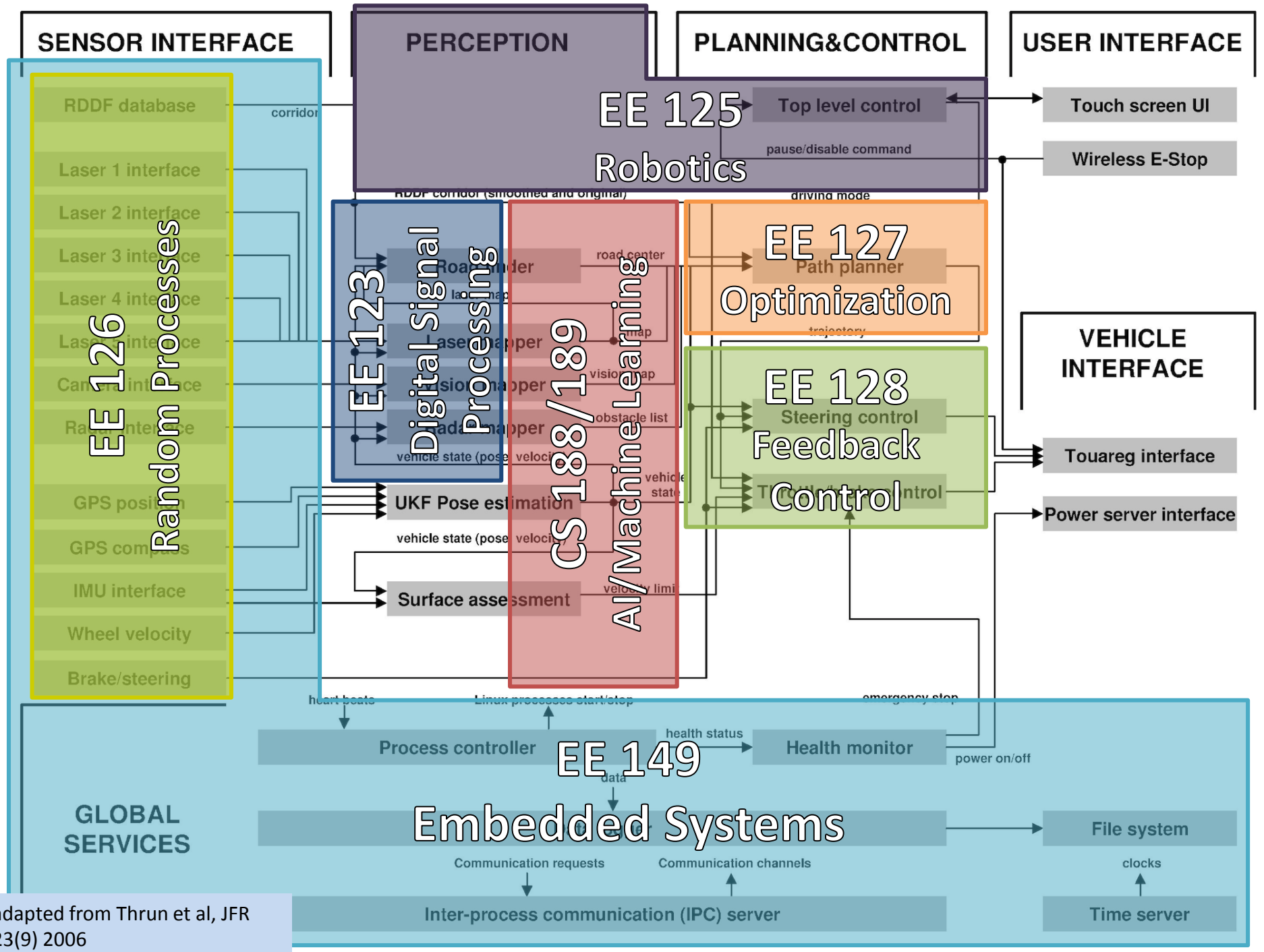
Hardware

Thrun et al Stanley 2005

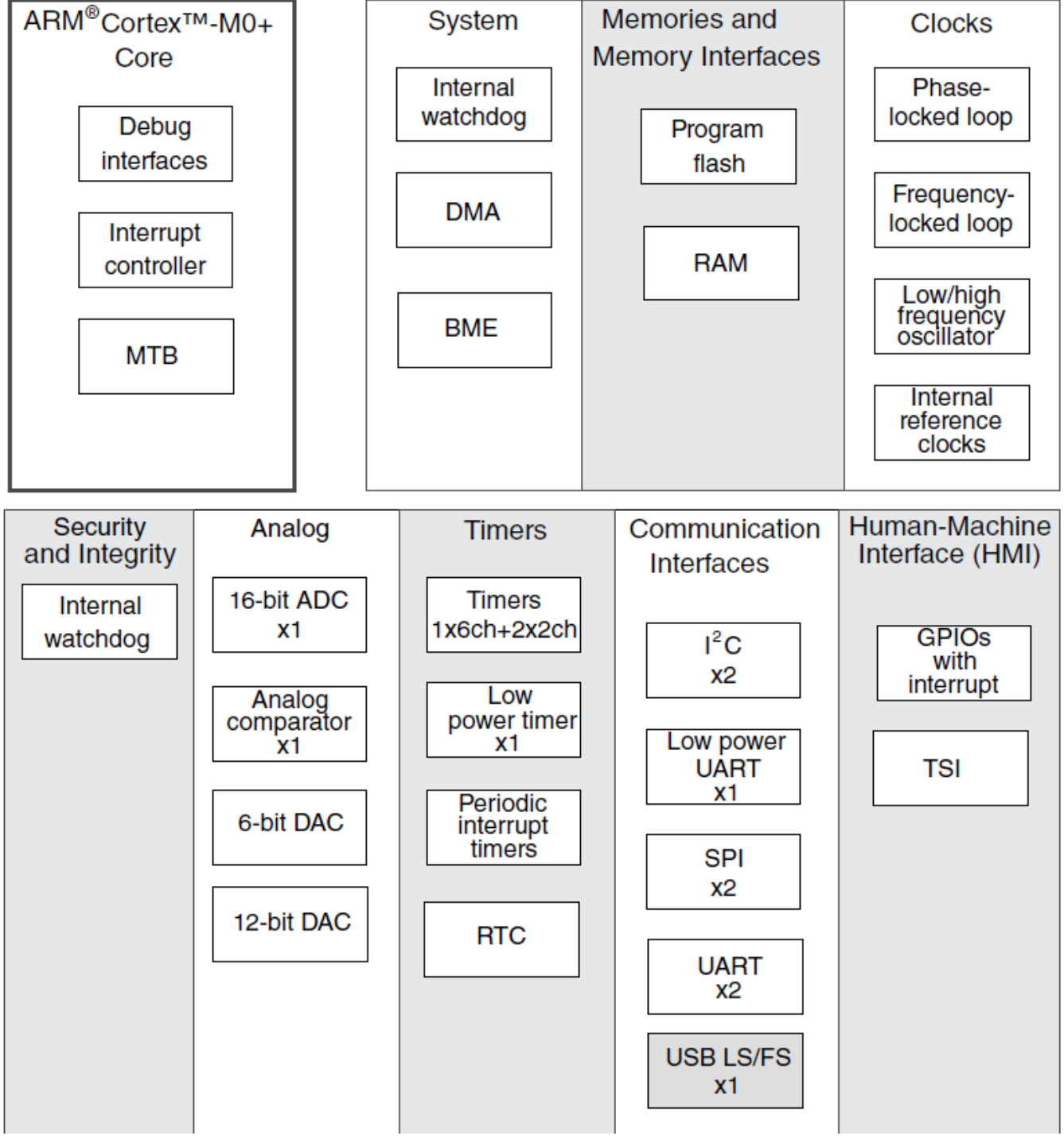




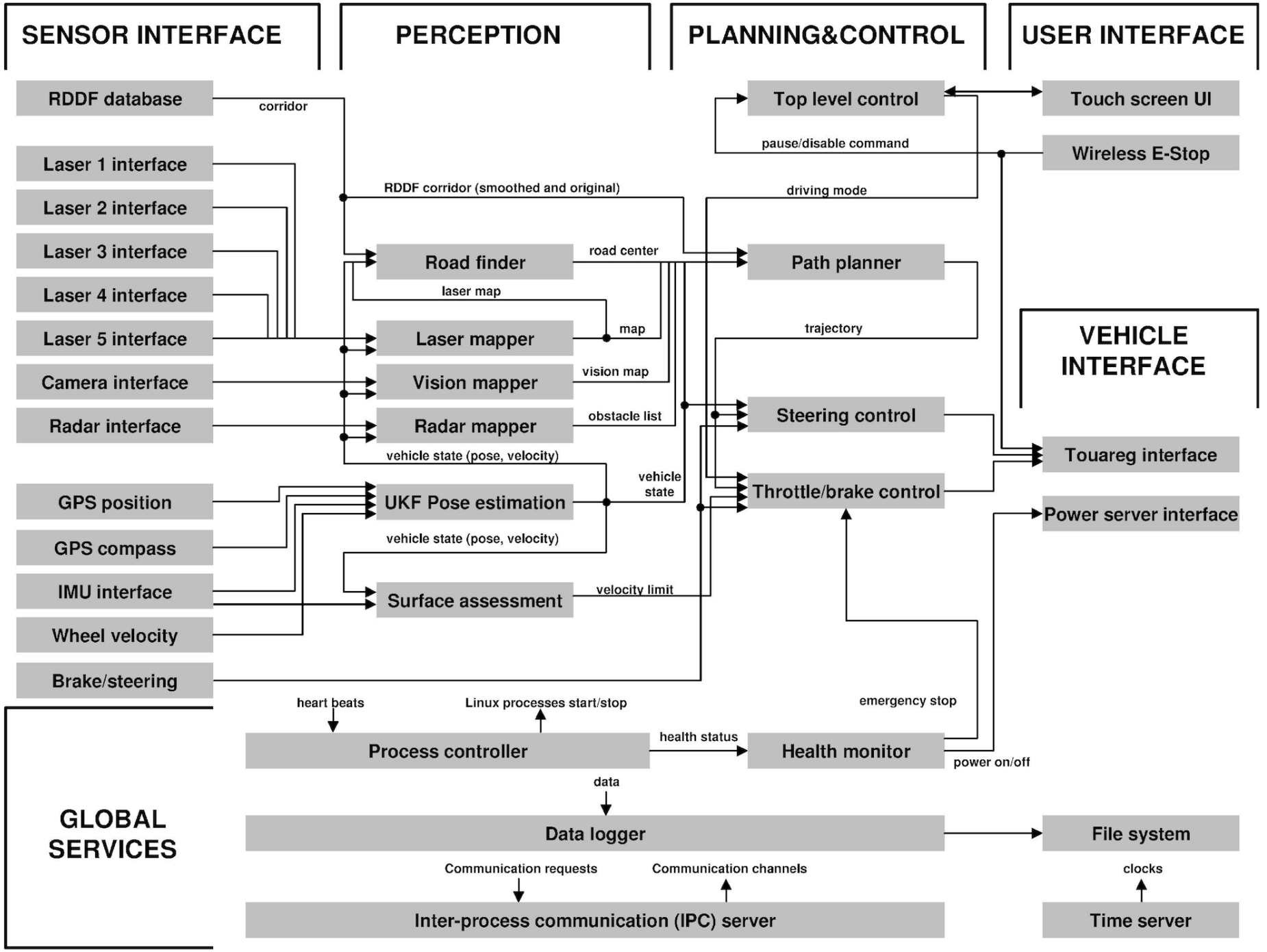
adapted from Thrun et al, JFR 23(9) 2006



adapted from Thrun et al, JFR 23(9) 2006



128K Flash
16K RAM
32 bit ARM 7 core
48 MHz
A/D, D/A
2x SPI
Touch sense input
Timers


SENSOR INTERFACE
PERCEPTION
PLANNING&CONTROL
USER INTERFACE
RDDF database
corridor
Laser 1 interface
Laser 2 interface
Laser 3 interface
Laser 4 interface
Laser 5 interface
Camera interface
Radar interface
GPS position
GPS compass
IMU interface
Wheel velocity
Brake/steering
RDDF corridor (smoothed and original)
Road finder
road center
laser map
Laser mapper
map
Vision mapper
vision map
Radar mapper
obstacle list
vehicle state (pose, velocity)
UKF Pose estimation
vehicle state
vehicle state (pose, velocity)
Surface assessment
velocity limit
Top level control
pause/disable command
driving mode
Path planner
trajectory
Steering control
Throttle/brake control
Touch screen UI
Wireless E-Stop
VEHICLE INTERFACE
Touareg interface
Power server interface
heart beats
Linux processes start/stop
emergency stop
Process controller
health status
Health monitor
power on/off
data
GLOBAL SERVICES
Data logger
File system
Communication requests
Communication channels
clocks
Inter-process communication (IPC) server
Time server

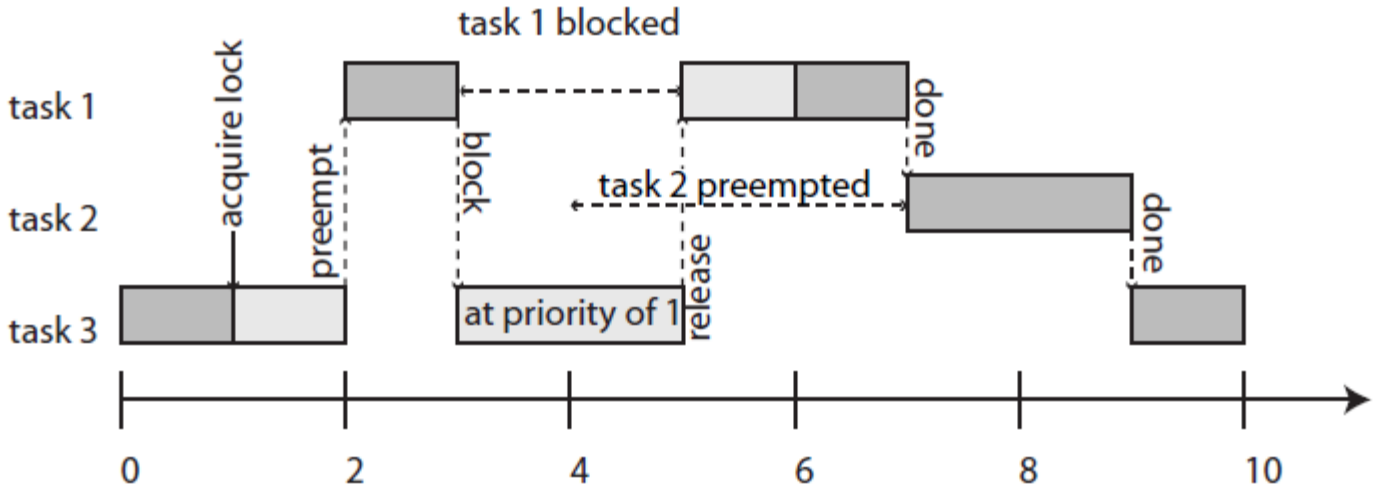
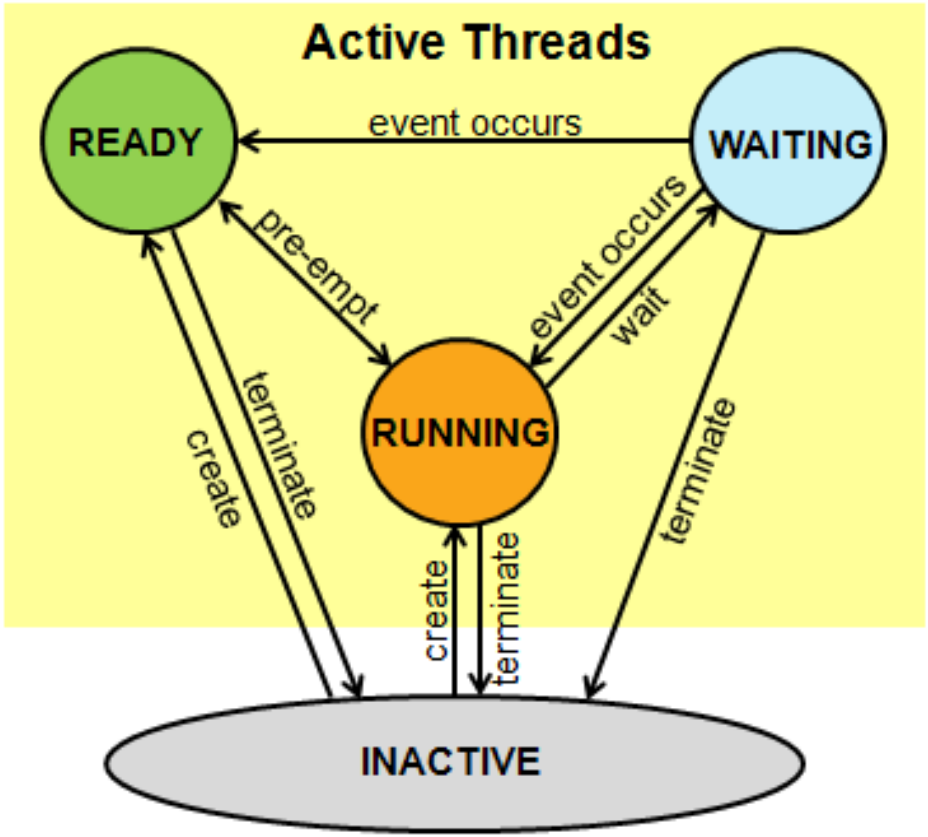
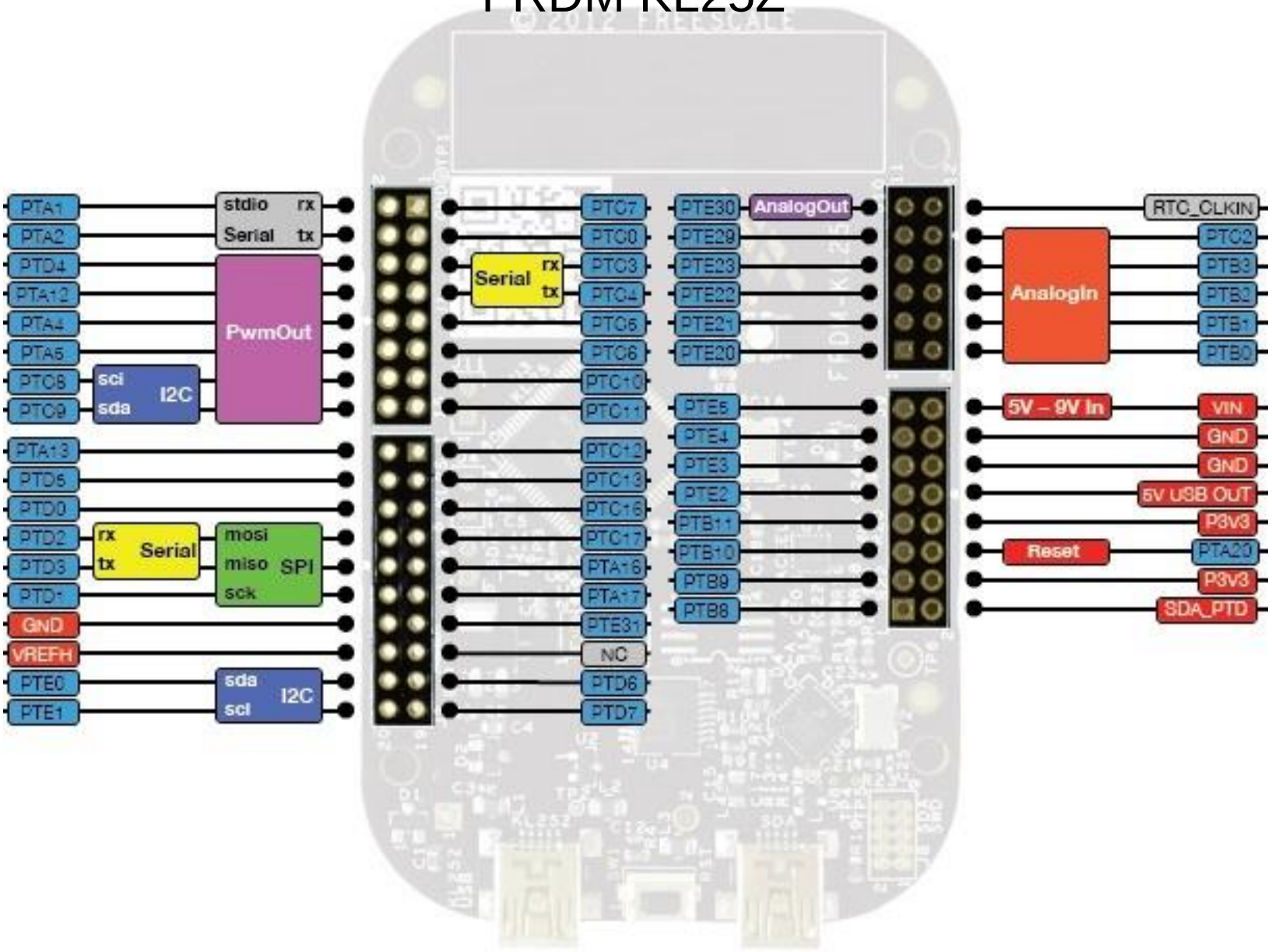


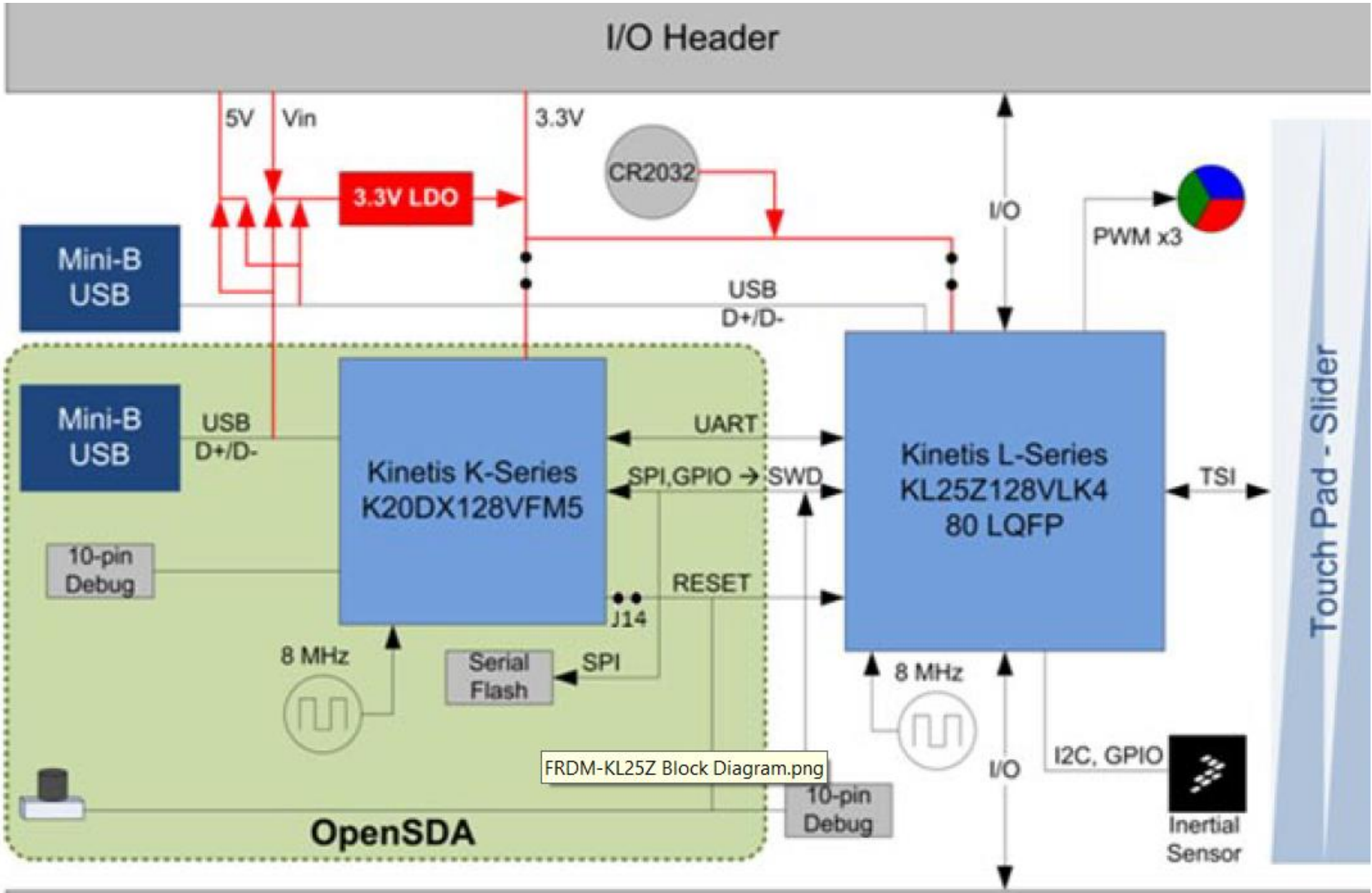
Figure 12.10: Illustration of the priority inheritance protocol. Task 1 has highest priority, task 3 lowest. Task 3 acquires a lock on a shared object, entering a critical section. It gets preempted by task 1, which then tries to acquire the lock and blocks. Task 3 inherits the priority of task 1, preventing preemption by task 2.



https://developer.mbed.org/handbook/RTOS

FRDM KL25Z


PTA1
PTA2
PTD4
PTA12
PTA4
PTA5
PTC8
PTC9
stdio
Serial
rx
tx
PwmOut
sci
sda
I2C
PTA13
PTD5
PTD0
PTD2
PTD3
PTD1
GND
VREFH
PTE0
PTE1
rx
tx
Serial
mosi
miso
sck
SPI
sda
scl
I2C
PTC7
PTC0
PTC3
PTC4
PTC5
PTC8
PTC10
PTC11
PTC12
PTC13
PTC16
PTC17
PTA16
PTA17
PTE31
NC
PTD6
PTD7
Serial
rx
tx
PTE30
PTE29
PTE23
PTE22
PTE21
PTE20
AnalogOut
PTE5
PTE4
PTE3
PTE2
PTB11
PTB10
PTB9
PTB8
RTC_CLKIN
PTC2
PTB3
PTB2
PTB1
PTB0
AnalogIn
5V – 9V In
VIN
GND
GND
5V USB OUT
P3V3
Reset
PTA20
P3V3
SDA_PTD


I/O Header
5V
Vin
3.3V
3.3V LDO
CR2032
I/O
PWM x3
Mini-B USB
USB D+/D-
Mini-B USB
USB D+/D-
Kinetis K-Series K20DX128VFM5
UART
SPI,GPIO → SWD
Kinetis L-Series KL25Z128VLK4 80 LQFP
TSI
Touch Pad - Slider
10-pin Debug
RESET
J14
8 MHz
Serial Flash
SPI
8 MHz
I2C, GPIO
I/O
10-pin Debug
Inertial Sensor
OpenSDA
FRDM-KL25Z Block Diagram.png
I/O Header