ALLNAMES:(OpenSynergy GmbH)

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1. **3975159** METHOD AND A SYSTEM FOR MEASURING THE LATENCY OF A GRAPHICAL DISPLAY OUTPUT EP - 30.03.2022

Int.Class G09G 3/00 **Appl.No** 20197801 **Applicant** OPENSYNERGY GMBH **Inventor** SHAIKHUTDINOV DAMIR

The present invention concerns a method for measuring the latency of a graphical display output, comprising the following steps:- obtaining, by a processor (5), a time value; - generating, by the processor (5), a time stamp based on the time value; - transmitting, by the processor, the time stamp to a graphics processor unit (7), GPU, rendering, by the GPU (7), a display frame including at least one graphical symbol being based on the time stamp; providing the rendered frame including the at least one graphical symbol to at least one display (10a, 10b); - capturing, by at least one camera (12), at least a portion of the display comprising the at least one graphical symbol (18, 20) of the time stamp;-determining from the at least one captured graphical symbol the rendered time stamp; and- comparing the rendered time stamp with a time reference for obtaining the latency of the graphical display output.

2. **3176674** METHOD FOR POWER CONTROL OF A CONTROL UNIT AND CONTROL UNIT EP - 07.06.2017

Int.Class G06F 1/32 **Appl.No** 15197787 **Applicant** OPENSYNERGY GMBH **Inventor** SONCK-THIEBAUT STEFAAN

The present invention relates to control unit (1) comprising: at least one processor (3) having an activated mode and a deactivated mode, at least one memory (5) connected to the at least one processor, and one or more wake-up sources (13, 17, 19, 26), wherein each wake-up source is connected to a microcontroller (9) to provide a wake-up signal to the microcontroller, the microcontroller (9) being connected to the at least one processor (3), wherein the microcontroller (9) is adapted to switch the at least one processor into the activated mode upon reception of at least one wake-up signal from a wake-up source monitored by the microcontroller, characterized in that the control unit (1) further comprises: a virtualization layer (40) adapted to run on the at least one processor, a first partition (32) provided by the virtualization layer, a power management module (44) running in first partition, at least one second partition (34, 36, 38) provided by the virtualization layer, wherein in each second partition at least one application module (46) is adapted to run, wherein the power management module (44) is adapted to configure the microcontroller (9) in dependence of at least one state of the at least one application module (46).

3. **3182282** METHOD FOR OPERATING A SYSTEM IN A CONTROL UNIT AND SYSTEM EP - 21.06.2017

Int.Class G06F 9/455 **Appl.No** 15200166 **Applicant** OPENSYNERGY GMBH **Inventor** SÖDING FREIHERR VON BLOMBERG AXEL

The present invention relates to a system (20), comprising at least one processor (3), and at least one memory (5), and at least one hardware interface (7) adapted to be connected to at least one peripheral device (9), the system further comprising: a virtualization layer (28) adapted to run on the at least one processor; a plurality of partitions adapted to run on the at least one virtualization layer, the virtualization layer being adapted to assign processor time and memory space to the plurality of partitions, the plurality of partitions comprising a first partition (22) and a plurality of second partitions (24), wherein the first partition includes a device driver (34) having access to the at least one hardware interface (7) and a sharing logic (36) adapted to control and provide access for the plurality of second partitions (24) to the device driver (7), wherein each second partition includes a virtual device driver for the at least one hardware interface (7); a plurality of inter partition communication link provided by the virtualization layer (28) for connecting the first partition (22) to each second partition (24, 26); and a sharing infrastructure (58) providing a connection between the sharing logic (36) and the virtual device drivers (38, 40) via the inter partition communication links.

4. **3678022** METHOD FOR OPERATING A SECOND CONTROL UNIT, A FIRST CONTROL UNIT AND A SYSTEM EP - 08.07.2020

Int.Class G06F 9/455 **Appl.No** 19150344 **Applicant** OPENSYNERGY GMBH **Inventor** MÖLL MATTI

The present invention relates to a method for operating a first control unit (1, 1a, 1b, 1a', 1b', 42) in order to transmit display commands over a computer network (13) to a second control unit (1, 1a, 1b, 1a', 1b', 46), comprising: generating, by an application (20a, 20b) at the first control unit, at least one display command, the at least one display command enabling a rendering of a frame comprising a three-dimensional image by a graphic processing unit (7a, 7b); receiving, by a graphic processing unit driver (22a, 22b) on the first control unit, the at least one display command; providing, by the graphic processing unit driver (22a, 22b) the at least one display command or graphic commands being transformed from the display commands to a virtual graphic processing unit device (26a, 26b); collecting, by the virtual graphic processing unit device (26a, 26b), a plurality of display commands or graphic commands being transformed from the display commands; determining parameters of the collected plurality of display commands or graphic commands stored in at least one section of the at least one memory (5) using at least one reference to the at least section of the at least one memory (5); aligning the display commands or graphic commands and their in sequential data, wherein the references to the at least one section of the at least one memory (5) is transformed to an offset within the sequential data; encapsulating, by virtual graphic processing unit device, the created sequential data in one or more network packets; transmitting the at least one network packet by the virtual graphic processing unit device (26a, 26b) over the computer network to a second control unit adapted to generate display frames of at least one image according to the display commands.

5. **3361711** METHOD FOR SYNCHRONIZING A SERVICE BETWEEN A SERVICE PROVIDER AND A SERVICE CONSUMER AND SYSTEM EP - 15.08.2018

Int.Class H04L 29/14 **Appl.No** 17155272 **Applicant** OPENSYNERGY GMBH **Inventor** SÖDING FREIHERR VON BLOMBERG ALEX

Method for synchronizing a communication session for a service, a service provider (30) running in a first operating system and a service consumer running in a second operating system, the method comprising: running a first state machine (50) in the first operating system; running a second state machine (60) in the second operating system; exchanging at least one message between the service provider (30) and the service consumer (34), such that the first state machine and the second state machine reach, respectively, a state (56, 66) that enable to establish the communication session between the service consumer and the service provider; entering, by the service provider and/or the service consumer, at least one state (52, 62) in which the service provider (30) is unavailable for the service consumer (34) and/or the service consumer (34) is unavailable for the service provider (30); and exchanging at least one

message between the service provider and the service consumer, such that the first state machine (50) and the second state machine (60) reach, respectively, a state (56, 66) that enables to either create a new session or to re-establish the same communication session between the service consumer and the service provider

6. **3113169** METHOD FOR CONTROLLING A GRAPHIC PROCESSING UNIT IN A CONTROL UNIT, IN PARTICULAR OF A VEHICLE, COMPUTER PROGRAM PRODUCT AND SYSTEM FOR AN EMBEDDED CONTROL UNIT — EP - 04.01.2017

Int.Class G09G 5/00 **Appl.No** 15175034 **Applicant** OPENSYNERGY GMBH **Inventor** TRETTER MICHAEL

The invention concerns a method for controlling a graphic processing unit, GPU, (17) in a control unit (1), in particular of a vehicle, the control unit comprising at least one central processing unit, CPU, the at least one CPU (3) having access to at least one memory (5); the GPU (17) being connected to and controlled by the at least one CPU (3), wherein the GPU (17) is adapted to provide frames to at least one display (13) having a predetermined output display frame rate, the method comprising: receiving (1000), by a GPU server (32) running on the CPU (3), a low priority graphical output from a first application (42), providing, by the GPU server (32), the low priority graphical output to the GPU (17), starting (1010), by the GPU (17), the rendering of the low priority graphical output, receiving (1020), by the GPU server (32), a time critical graphical output from a second application (44); determining a first point in time (t3) before the next frame (n+2) to be provided to the at least one display (13) based on second point in time (t4), when the next frame (n+2) is to be provided to the at least one display (13), and the maximal time needed to display the time critical graphical output on the at least one display (13) using the GPU (17); and forcing (1050), at the determined first point in time (t3), by the GPU server (32), the GPU (17) to render the time critical graphical output, if at the determined first point in time the GPU (17) still renders the low priority graphical output

7. **3355188** INSTRUMENT DISPLAY ON A CAR DASHBOARD BY CHECKING FRAMES OF A GUI BY A REALTIME OS — EP - 01.08.2018

Int.Class G06F 3/147 **Appl.No** 17153995 **Applicant** OPENSYNERGY GMBH **Inventor** PETER MICHAEL

The present invention relates to a method for operating a control device (1) comprising at least one processor (3) and at least one memory (5) connected to the at least one processor, the method comprising: running a virtualization layer on the at least one processor, the virtualization layer being adapted to assign processor time and memory to a plurality of guest systems running on the virtualization layer, the plurality of guest systems comprising a first guest operating system and a second guest operating system, wherein the first guest operating system is a real time operating system, obtaining, by the second guest system, information to be displayed on at least one display; preparing, by the second guest system, at least one display frame to be sent to the at least one display; reading, by the first guest system, at least one portion of the at least one display frame or retrieving, by the first guest system, information about a read at least one portion of the at least one display frame, and determining, by the first guest system, whether the information sent to the second operating system is correctly generated in the display frame based on the at least one portion.

8. **20210103455** METHOD FOR OPERATING A CONTROL DEVICE, CONTROL DEVICE AND COMPUTER PROGRAM PRODUCT — US - 08.04.2021

Int.Class G06F 9/455 **Appl.No** 16481837 **Applicant** OpenSynergy GmbH **Inventor** Michael Peter

A method including running a virtualization layer on a processor, the virtualization layer being adapted to assign processor time and memory to first and second guest operating systems running on the virtualization layer, wherein the first guest operating system is a real time operating system, obtaining, by the second guest system, information to be displayed on a display, preparing, by the second guest system, a display frame to be sent to the display, reading, by the first guest system, a portion of the display frame, or retrieving, by the first guest system, information about a read portion of the display frame, and determining, by the first guest system, whether the information sent to the second guest system is correctly generated in the display frame.

9. **WO/2018/141629** METHOD FOR OPERATING A CONTROL DEVICE, CONTROL DEVICE AND COMPUTER PROGRAM PRODUCT — WO - 09.08.2018

Int.Class G06F 9/455 **Appl.No** PCT/EP2018/051854 **Applicant** OPENSYNERGY GMBH **Inventor** PETER, Michael

The present invention relates to a method for operating a control device (1) comprising at least one processor (3) and at least one memory (5) connected to the at least one processor, the method comprising: running a virtualization layer on the at least one processor, the virtualization layer being adapted to assign processor time and memory to a plurality of guest systems running on the virtualization layer, the plurality of guest systems comprising a first guest operating system and a second guest operating system, wherein the first guest operating system is a real time operating system, obtaining, by the second guest system, information to be displayed on at least one display; preparing, by the second guest system, at least one display frame to be sent to the at least one display; reading, by the first guest system, at least one portion of the at least one display frame or retrieving, by the first guest system, information about a read at least one portion of the at least one display frame, and determining, by the first guest system, whether the information sent to the second operating system is correctly generated in the display frame based on the at least one portion.

10. **3617927** CONTROL UNIT AND METHOD FOR OPERATING A CONTROL UNIT — EP - 04.03.2020

Int.Class G06F 21/74 **Appl.No** 18191617 **Applicant** OPENSYNERGY GMBH **Inventor** PETER MICHAEL

The present invention relates to a control unit (1) comprising a processor (3) and a memory (5) connected to the processor the processor comprising a first state and a second state and being adapted to switch between the first state and the second state, wherein in the first state a non-trusted system (24) is active and in the second state a trusted system (22) is active, wherein the control unit comprises a system monitor (26) controlling the activation of the first state and the second state, the memory (5) including a first portion (42) assigned to the trusted system (22) and a second portion (44) assigned to the non-trusted system (24), wherein the system monitor (26) is adapted to inhibit the access of the non-trusted system (24) to the first portion (42) of the memory (5), wherein the trusted system (22) includes a safety module (30) and at least one trusted module (32, 34), the at least one trusted module (32, 34) being loaded in a chain of trust and running on the safety module (30), wherein the safety module (30) being adapted to control access of the at least one trusted module to predefined areas (56, 60) of the second portion (44) of the memory.

11. **3343366** SYSTEM AND METHOD FOR SCHEDULING A PLURALITY OF GUEST SYSTEMS AND/OR THREADS — EP - 04.07.2018

Int.Class G06F 9/48 **Appl.No** 16207006 **Applicant** OPENSYNERGY GMBH **Inventor** PETER MICHAEL

The present invention concerns a method for scheduling a plurality of guest systems (22, 24) and/or threads (42) in a system, the system comprising a virtualization system (26) running on a processor (3), the virtualization system (26) being adapted to assign processor time and memory space to a plurality of guest systems (22, 24) and comprising a virtualization system scheduler (66), the method including: - running a first guest system (22) on the virtualization system (26), the first guest system comprising at least one first thread (42) and at least one second thread (44, 46) running in the first guest system (22), and a guest system scheduler (62) adapted to assign processing time to the at least one second thread (44, 46), - assigning, in the virtualization system (26), a plurality of time reservations to the first guest system (22) of the first guest system, wherein the plurality of time reservations include a first time reservation associated to one first thread (42) and a second time associated to the guest system scheduler of the first guest system (22), - assigning processor time, by the virtualization system scheduler (66), to the first guest system (22) according to the second time reservation, and -

assigning processor time, by the virtualization system scheduler [66], to the at least one first thread [42] of the first guest system [22] according to the first time reservation.

12. **20200081737** SYSTEM AND METHOD FOR SCHEDULING A PLURALITY OF GUEST SYSTEMS AND/OR THREADS US - 12.03.2020

Int.Class G06F 9/48 **Appl.No** 16468288 **Applicant** OpenSynergy GmbH **Inventor** Michael Peter

A method for scheduling guest systems and/or threads in a virtualization system that assigns processor time and memory space to guest systems and including a virtualization system scheduler, the method including running a first guest system that includes at least one first thread and at least one second thread running in the first guest system, and a guest system scheduler that assigns processing time to the at least one second thread, assigning a plurality of time reservations to the first guest system, wherein the plurality of time reservations include a first time reservation associated to one first thread and a second time reservation associated to the guest system scheduler of the first guest system, assigning processor time to the first guest system according to the second time reservation, and assigning processor time to the at least one first thread of the first guest system according to the first time reservation.

13. **WO/2018/122260** SYSTEM AND METHOD FOR SCHEDULING A PLURALITY OF GUEST SYSTEMS AND/OR THREADS WO - 05.07.2018

Int.Class G06F 9/48 **Appl.No** PCT/EP2017/084640 **Applicant** OPENSYNERGY GMBH **Inventor** PETER, Michael

The present invention concerns a method for scheduling a plurality of guest systems [22, 24] and/or threads [42] in a system, the system comprising a virtualization system [26] running on a processor [3], the virtualization system [26] being adapted to assign processor time and memory space to a plurality of guest systems [22, 24] and comprising a virtualization system scheduler [66], the method including: - running a first guest system [22] on the virtualization system [26], the first guest system comprising at least one first thread [42] and at least one second thread [44, 46] running in the first guest system [22], and a guest system scheduler [62] adapted to assign processing time to the at least one second thread [44, 46], - assigning, in the virtualization system [26], a plurality of time reservations to the first guest system [22] of the first guest system, wherein the plurality of time reservations include a first time reservation associated to one first thread [42] and a second time associated to the guest system scheduler of the first guest system [22], - assigning processor time, by the virtualization system scheduler [66], to the first guest system [22] according to the second time reservation, and - assigning processor time, by the virtualization system scheduler [66], to the at least one first thread [42] of the first guest system [22] according to the first time reservation.

14. **3101535** METHOD FOR UPDATING A CONTROL UNIT FOR AN AUTOMOTIVE VEHICLE, CONTROL UNIT FOR AN AUTOMOTIVE VEHICLE, AND COMPUTER PROGRAM PRODUCT EP - 07.12.2016

Int.Class G06F 8/65 **Appl.No** 15170139 **Applicant** OPENSYNERGY GMBH **Inventor** GOLTZ CHRISTIAN

The present invention relates to a method for updating a control unit [1] for an automotive vehicle, the control unit comprising a runtime system [22, 122] with a virtualization layer [32, 132] adapted to run on the processor [3], the virtualization layer being adapted to assign processor time and memory space to a plurality of guest systems [24, 26, 28, 30, 124, 126, 128, 130, 158], the method comprising: downloading [1018], by a first update client [38, 40, 138, 140] of a first untrusted guest system [26, 28] running on the virtualization layer [32, 132], one or more first update files or data segments from a first remote server [44, 46, 48, 144, 146, 148]; storing, by the first update client [38, 40, 138, 140], the one or more first update files or data segments in an untrusted memory [5] accessible to the first untrusted guest system; running an update operating system [58, 158] adapted to update one or more files or data segments of the control unit; retrieving, by the updating operating system [58, 158], the one or more first update files or data segments from the untrusted memory [5]; and updating [1108, 1110, 1112, 1114] the one or more files or data segments of the control unit [1].

15. **20180173515** METHOD FOR UPDATING A CONTROL UNIT FOR AN AUTOMOTIVE VEHICLE, CONTROL UNIT FOR AN AUTOMOTIVE VEHICLE, AND COMPUTER PROGRAM PRODUCT US - 21.06.2018

Int.Class G06F 8/65 **Appl.No** 15578724 **Applicant** OpenSynergy GmbH **Inventor** Christian Goltz

The present invention relates to a method for updating a control unit [**1**] for an automotive vehicle, the control unit comprising a runtime system [**22, 122**] with a virtualization layer [**32, 132**] adapted to run on the processor [**3**], the virtualization layer being adapted to assign processor time and memory space to a plurality of guest systems [**24, 26, 28, 30, 124, 126, 128, 130, 158**], the method comprising: downloading [**1018**], by a first update client [**38, 40, 138, 140**] of a first untrusted guest system [**26, 28**] running on the virtualization layer [**32, 132**], one or more first update files or data segments from a first remote server [**44, 46, 48, 144, 146, 148**]; storing, by the first update client [**38, 40, 138, 140**], the one or more first update files or data segments in an untrusted memory [**5**] accessible to the first untrusted guest system; running an update operating system [**58, 158**] adapted to update one or more files or data segments of the control unit; retrieving, by the updating operating system [**58, 158**], the one or more first update files or data segments from the untrusted memory [**5**]; and updating [**1108, 1110, 1112, 1114**] the one or more files or data segments of the control unit [**1**].

16. **WO/2016/193278** METHOD FOR UPDATING A CONTROL UNIT FOR AN AUTOMOTIVE VEHICLE, CONTROL UNIT FOR AN AUTOMOTIVE VEHICLE, AND COMPUTER PROGRAM PRODUCT WO - 08.12.2016

Int.Class G06F 9/445 **Appl.No** PCT/EP2016/062320 **Applicant** OPENSYNERGY GMBH **Inventor** GOLTZ, Christian

The present invention relates to a method for updating a control unit [1] for an automotive vehicle, the control unit comprising a runtime system [22, 122] with a virtualization layer [32, 132] adapted to run on the processor [3], the virtualization layer being adapted to assign processor time and memory space to a plurality of guest systems [24, 26, 28, 30, 124, 126, 128, 130, 158], the method comprising: downloading [1018], by a first update client [38, 40, 138, 140] of a first untrusted guest system [26, 28] running on the virtualization layer [32, 132], one or more first update files or data segments from a first remote server [44, 46, 48, 144, 146, 148]; storing, by the first update client [38, 40, 138, 140], the one or more first update files or data segments in an untrusted memory [5] accessible to the first untrusted guest system; running an update operating system [58, 158] adapted to update one or more files or data segments of the control unit; retrieving, by the updating operating system [58, 158], the one or more first update files or data segments from the untrusted memory [5]; and updating [1108, 1110, 1112, 1114] the one or more files or data segments of the control unit [1].

17. **20100292867** MOTOR VEHICLE CONTROL DEVICE US - 18.11.2010

Int.Class G06F 19/00 **Appl.No** 12809511 **Applicant** OPENSYNERGY GMBH **Inventor** Böhm Frank-Peter

According to the invention, a motor vehicle control device is provided, comprising: a microkernel; several entities; and a software bus, via which the entities can communicate with each other and with the kernel, wherein one or more of the entities represent respectively one or more modules of the AUTOSAR base software. The present invention is based inter alia on the idea of representing the AUTOSAR architecture on a microkernel-based architecture. Thereby, the motor vehicle control device according to the invention makes it possible for example to link infotainment applications with AUTOSAR-based applications.

18. **2235628** MOTOR VEHICLE CONTROL DEVICE — EP - 06.10.2010

Int.Class B60W 50/06 **Appl.No** 08864810 **Applicant** OPENSYNERGY GMBH **Inventor** BÖHM FRANK-PETER

The invention relates to a motor vehicle control device, comprising: a microkernel; a plurality of entities; and a software bus, by means of which the entities can communicate with each other and with the kernel, wherein one or more of the entities each represent one or more modules of the AUTOSAR base software. The present invention is based on the idea of representing AUTOSAR architecture in a micro-kernel-based architecture. The motor vehicle control device according to the invention is thereby enabled, for example, to link infotainment applications with AUTOSAR-based applications.

19. **3099019** METHOD, COMPUTER PROGRAM PRODUCT, AND CONTROL UNIT FOR AN AUTOMOTIVE VEHICLE — EP - 30.11.2016

Int.Class H04L 12/40 **Appl.No** 15169408 **Applicant** OPENSYNERGY GMBH **Inventor** PRANTNER HEINZ

The invention relates to a method for accessing on a control unit for an automotive vehicle a field bus, the field bus being a dedicated automotive bus and being adapted to transport messages having a message identifier, the message identifier defining the content of the message, the control unit having at least one processor and a memory, comprising: assigning, by a virtualizing layer, resources of the at least one processor and the memory to a plurality of guest systems; enabling, by the virtualizing layer, a communication between at least two of the guest systems via an inter partition communication link; receiving one or more messages from the field bus by a hardware driver of first guest system running on the virtualizing layer, the first guest system being a real time operating system; providing, by the hardware driver, the one more messages to a message forwarding component of the first guest system; forwarding, by the message forwarding component, at least one of the received messages to a first virtual driver of a second guest system running on the virtualization layer via the inter partition communication link; and providing, by the first virtual driver, the messages received by the first virtual driver, to a component or application of the second guest system.

20. **202008016892** KRAFTFAHRZEUG-STEUERVORRICHTUNG — DE - 20.05.2009

Int.Class G06F 9/6 **Appl.No** 202008016892 **Applicant** OPENSYNERGY GMBH **Inventor**

21. **102007062114** KRAFTFAHRZEUG-STEUERVORRICHTUNG — DE - 23.07.2009

Int.Class G06F 9/46 **Appl.No** 102007062114 **Applicant** OPENSYNERGY GMBH **Inventor**

Erfindungsgemäß ist eine Kraftfahrzeug-Steuervorrichtung geschaffen, umfassend: einen Mikrokernel; mehrere Entitäten; und einen Software-Bus, über den die Entitäten untereinander und mit dem Kernel kommunizieren können, wobei eine oder mehrere der Entitäten jeweils ein oder mehrere Module der AUTOSAR-Basissoftware abbilden. Der vorliegenden Erfindung liegt u. a. die Idee zu Grunde, die AUTOSAR-Architektur auf eine Mikrokernel-basierte Architektur abzubilden. Dadurch ermöglicht es die erfindungsgemäße Kraftfahrzeug-Steuervorrichtung, beispielsweise Infotainment-Applikationen mit AUTOSAR-basierten Applikationen zu verknüpfen.

22. **3336698** SYSTEM COMPRISING A PLURALITY OF VIRTUALIZATION SYSTEMS — EP - 20.06.2018

Int.Class G06F 21/60 **Appl.No** 16205067 **Applicant** OPENSYNERGY GMBH **Inventor** PETER MICHAEL

The present invention concerns a system (20) comprising a processor (3) with a plurality of cores (7a, 7b, 7c, 7d) having the same instruction set architecture, at least one memory (5) connected to the processor, a plurality of virtualization systems (22a, 22b, 22c) adapted to run respectively on one core (7a, 7b, 7c, 7d), the plurality of virtualization systems including a first virtualization system (22a) adapted to run on a first core (7a) and a second virtualization system (22c) adapted to run on a second core (7c), wherein the first virtualization system has a first characteristic with a first parameter and the second virtualization system has a second characteristic with a second parameter, wherein the parameter of the first characteristic and the parameter of the second characteristic are incompatible when implemented in a single virtualization system; and communication module (36) for enabling the plurality of virtualization systems (22a, 22b, 22c) to communicate with each other.

23. **20190303214** SYSTEM COMPRISING A PLURALITY OF VIRTUALIZATION SYSTEMS — US - 03.10.2019

Int.Class G06F 9/54 **Appl.No** 16466637 **Applicant** OpenSynergy GmbH **Inventor** Michael Peter

A system including a processor with a plurality of cores having the same instruction set architecture, at least one memory connected to the processor, a plurality of virtualization systems adapted to run respectively on one core, the plurality of virtualization systems including a first virtualization system adapted to run on a first core and a second virtualization system adapted to run on a second core, wherein the first virtualization system has a first characteristic with a first parameter and the second virtualization system has a second characteristic with a second parameter, wherein the parameter of the first characteristic and the parameter of the second characteristic are incompatible when implemented in a single virtualization system; and communication module for enabling the plurality of virtualization systems to communicate with each other.

24. **WO/2018/114944** SYSTEM COMPRISING A PLURALITY OF VIRTUALIZATION SYSTEMS — WO - 28.06.2018

Int.Class G06F 9/54 **Appl.No** PCT/EP2017/083532 **Applicant** OPENSYNERGY GMBH **Inventor** PETER, Michael

The present invention concerns a system (20) comprising a processor (3) with a plurality of cores (7a, 7b, 7c, 7d) having the same instruction set architecture, at least one memory (5) connected to the processor, a plurality of virtualization systems (22a, 22b, 22c) adapted to run respectively on one core (7a, 7b, 7c, 7d), the plurality of virtualization systems including a first virtualization system (22a) adapted to run on a first core (7a) and a second virtualization system (22c) adapted to run on a second core (7c), wherein the first virtualization system has a first characteristic with a first parameter and the second virtualization system has a second characteristic with a second parameter, wherein the parameter of the first characteristic and the parameter of the second characteristic are incompatible when implemented in a single virtualization system; and communication module (36) for enabling the plurality of virtualization systems (22a, 22b, 22c) to communicate with each other.

25. **WO/2019/072624** CONTROL UNIT, METHOD FOR OPERATING A CONTROL UNIT, METHOD FOR CONFIGURING A VIRTUALIZATION SYSTEM OF A CONTROL UNIT — WO - 18.04.2019

Int.Class G06F 9/455 **Appl.No** PCT/EP2018/076722 **Applicant** OPENSYNERGY GMBH **Inventor** PRANTNER, Heinz

The invention concerns a control unit (1), the control unit comprising at least one processor (3) and at least one memory (5) connected to the processor, the control unit further comprising a virtualization system (22) and a plurality of virtual machines (24, 26, 28, VM A, VM B, VM C, VM D, VM E) running on the virtualization system (22), the virtualization system including a scheduler (30) for scheduling the plurality of virtual machines (24, 26, 28, VM A, VM B, VM C, VM D, VM E) to assign processing time to each of the virtual machines according to a predetermined fixed sequence of virtual machine switches forming a

cycle period, which is repeated, the cycle period being the minimum time period after which the scheduling is repeated, wherein the virtualization system and the plurality of virtual machines are real-time systems, the virtual machines having respectively at least one real-time attribute, wherein at least one the real time attribute of a first virtual machine are different to the corresponding real-time attribute[s] of a second virtual machine, wherein predetermined fixed sequence of virtual machine switches is calculated based on the at least one real time attribute.

26. **3470980** CONTROL UNIT, METHOD FOR OPERATING A CONTROL UNIT, METHOD FOR CONFIGURING A VIRTUALIZATION SYSTEM OF A CONTROL UNIT — EP - 17.04.2019

Int.Class G06F 9/455 **Appl.No** 17195697 **Applicant** OPENSYNERGY GMBH **Inventor** PRANTNER HEINZ

The invention concerns a control unit (1), the control unit comprising at least one processor (3) and at least one memory (5) connected to the processor, the control unit further comprising a virtualization system (22) and a plurality of virtual machines (24, 26, 28, VM A, VM B, VM C, VM D, VM E) running on the virtualization system (22), the virtualization system including a scheduler (30) for scheduling the plurality of virtual machines (24, 26, 28, VM A, VM B, VM C, VM D, VM E) to assign processing time to each of the virtual machines according to a predetermined fixed sequence of virtual machine switches forming a cycle period, which is repeated, the cycle period being the minimum time period after which the scheduling is repeated, wherein the virtualization system and the plurality of virtual machines are real-time systems, the virtual machines having respectively at least one real-time attribute, wherein at least one the real time attribute of a first virtual machine are different to the corresponding real-time attribute[s] of a second virtual machine, wherein predetermined fixed sequence of virtual machine switches is calculated based on the at least one real time attribute.

27. **20200326980** CONTROL UNIT HAVING A SCHEDULER FOR SCHEDULING A PLURALITY OF VIRTUAL MACHINES, AND METHODS FOR SCHEDULING A PLURALITY OF VIRTUAL MACHINES — US - 15.10.2020

Int.Class G06F 9/455 **Appl.No** 16755135 **Applicant** OpenSynergy GmbH **Inventor** Heinz Prantner

A control unit including at least one processor and at least one memory connected to the at least one processor, a virtualization system, the virtualization system including a scheduler for scheduling a plurality of virtual machines to assign processing time to each of the virtual machines according to a predetermined fixed sequence of virtual machine switches forming a cycle period, which is repeated, the cycle period being the minimum time period after which the scheduling is repeated, wherein the virtualization system and the plurality of virtual machines are real-time systems, the virtual machines having respectively at least one real-time attribute, wherein at least one the real time attribute of a first virtual machine are different to the corresponding real-time attribute[s] of a second virtual machine, wherein predetermined fixed sequence of virtual machine switches is calculated based on the at least one real time attribute.

28. **101946234** MOTOR VEHICLE CONTROL DEVICE — CN - 12.01.2011

Int.Class G06F 9/455 **Appl.No** 200880126850.9 **Applicant** Opensynergy GmbH **Inventor** Boehm Frank-peter

The invention relates to a motor vehicle control device, comprising: a microkernel; a plurality of entities; and a software bus, by means of which the entities can communicate with each other and with the kernel, wherein one or more of the entities each represent one or more modules of the AUTOSAR base software. The present invention is based on the idea of representing AUTOSAR architecture in a micro-kernel-based architecture. The motor vehicle control device according to the invention is thereby enabled, for example, to link infotainment applications with AUTOSAR-based applications.

29. **WO/2009/080015** MOTOR VEHICLE CONTROL DEVICE — WO - 02.07.2009

Int.Class G06F 9/455 **Appl.No** PCT/DE2008/002137 **Applicant** OPENSYNERGY GMBH **Inventor** BÖHM, Frank-Peter

The invention relates to a motor vehicle control device, comprising: a microkernel; a plurality of entities; and a software bus, by means of which the entities can communicate with each other and with the kernel, wherein one or more of the entities each represent one or more modules of the AUTOSAR base software. The present invention is based on the idea of representing AUTOSAR architecture in a micro-kernel-based architecture. The motor vehicle control device according to the invention is thereby enabled, for example, to link infotainment applications with AUTOSAR-based applications.