XNG support to GR740

GR740 User Day 2022

Vicente Nicolau-Gallego
vnicolau@fentiss.com

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Outline

- fentISS, the company
- What is XNG?
- Features of XNG
- XNG vs XMQ/XM4
- XNG over GR740 current status

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fentISS, the company

- fentISS: Fent Innovative Software Solutions, spin-off of the UPV
- SME developing embedded system software for mixed criticality applications (XtratuM hypervisor)
- fentISS enables critical and non-critical applications to share a common hardware platform without interfering with one another
- Business focused in the aerospace market: currently +500 satellites orbiting Earth using XtratuM and LithOS/RTEMS BSP
- XtratuM selected:
  - by six additional satellite constellations and minisatellites (OBC)
  - by five conventional missions (large satellites, payload)

fentISS, the company

Products

- XtratuM qualified hypervisor
  - Time and Space Partitioning (TSP)
- XtratuM Runtime Environment
  - Minimum executable system
- LithOS
  - ARINC-653 P1 compliant guest OS by fentISS
- Guest OS BSPs
  - RTEMS, Linux
- Support Tools
  - Configuration, Real-Time Scheduling, Observability & Emulation

Services

- Support
- Porting and customization
- Training

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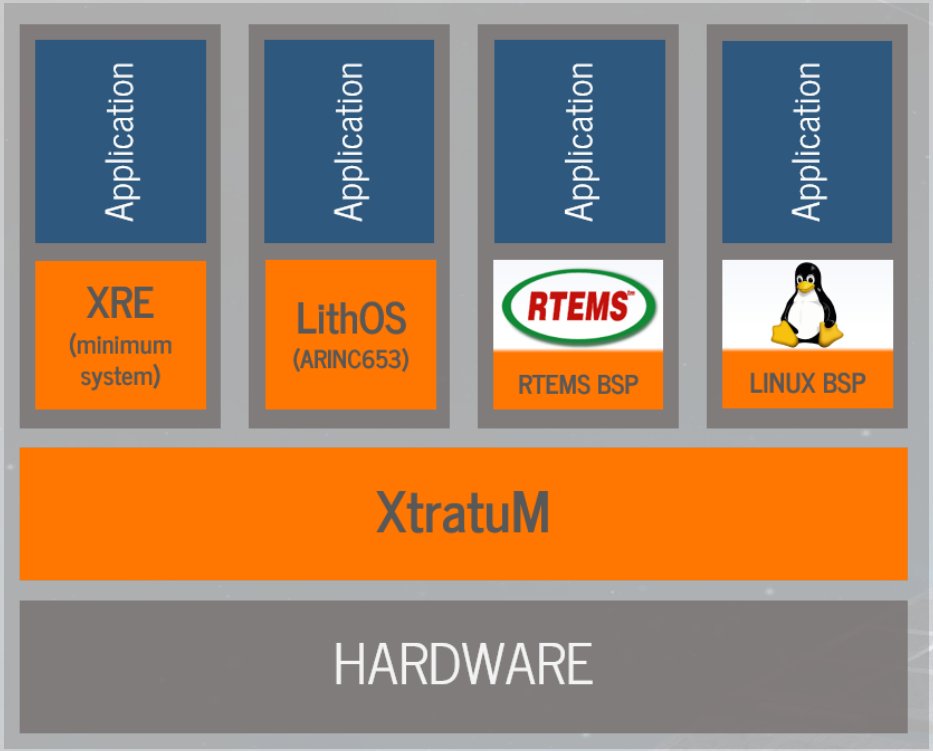

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What is XNG?

- XNG stands for XtratuM Next Generation
- XNG is a bare metal partitioning kernel providing time and space isolation over the same hardware platform aimed to safety mixed-critical applications
- XNG is a complete rewrite of the XtratuM hypervisor that builds on the accumulated expertise after working for more than 15 years in the development of the XtratuM and its variants (XM2, XM3, XM4, XMQ…)
- Among all the supported architectures, XNG now supports SPARCv8 architecture (LEON4) in the GR740 board
- ECSS category B qualified under a set of architectures

XNG, XMQ & XM4

- GR740 board not new for fentISS
- XM4
  - XtratuM 4, released in 2010
  - 1st version supporting LEON4 in GR740 multicore
  - Used by space agencies and prime contractors
- XMQ 2.2.0
  - XtratuM Qualified v2.2.0, released in 2020
  - Supporting LEON3/4 in GR712/GR740 multicore
  - Used by space agencies and prime contractors
- But XM4 & XMQ discontinued in favour of XNG
  - fentISS promoting the use of XNG

Features of XNG

- XNG hypervisor provides:
  - A (static) cycling scheduler policy
  - (Static) configuration through XML files
    - Defines and configures the system, distributes resources...
  - Partitions (i.e. application software):
    - Execution environments isolated in time (scheduling) and space (memory) for user applications
    - Run in a Partition Virtual Execution Environment (PVEE) mimicking the underlying HW
    - Safe interpartition communication using sampling and queuing ports
    - Delegation of I/O devices/interrupts to partitions to allow a partition to manage a special I/O device

Features of XNG

- Provides a C interface for its services (hypercalls)
- Hardware platform management
  - Distributes physical resources, SMP model, manages interrupts and exceptions, delegates HW devices to partitions
- Hypervisor management
  - Services to cold/warm reset, halt or retrieve statuses
- Partition Management
  - Services to cold/warm reset, halt/suspend or retrieve statuses
- Inter-partition communication mechanisms
  - Sampling and queueing ports (ARINC 653-like)
- Inter-partition virtual interrupts
- Health monitoring support (ARINC 653-like)
- Tracing support

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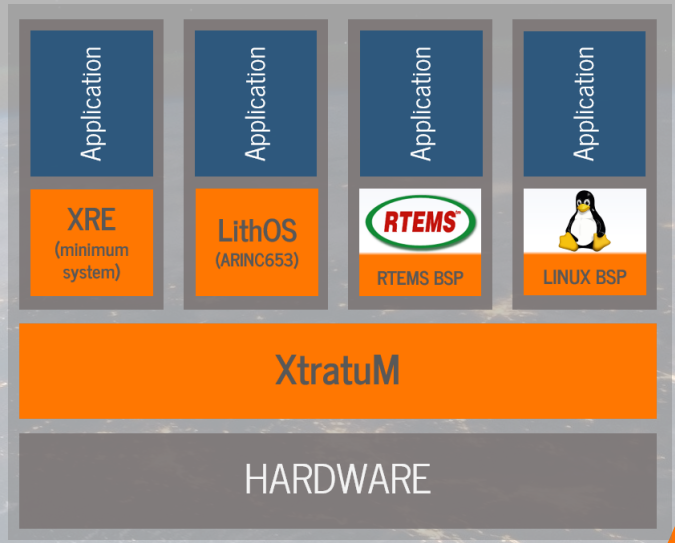
Features of XNG

- Typical software stack
  - Partitions with XRE
    - XtratuM Execution Runtime
    - Minimal system to build an application (bare metal over XNG)
    - XNG + XRE: building blocks of the partitioning kernel
  - Partitions with multiple OSes and run-time personalities
    - LithOS
      - ARINC 653 P1 compliant guest OS by fentISS
    - RTEMS BSP
    - Linux BSP



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XNG vs XMQ/XM4

- XM4 limited to one architecture, processor and board
- XMQ limited to one architecture
- XNG designed to support many architectures, processors and boards sharing common parts
- XNG keeps the application interface and functionality among all its versions, opposite to XM4 and XMQ
  - Porting of applications among XNG versions with no modifications
- XNG includes more support tools than XM4/XMQ:
  - Observability tools
  - Tracing logs facility
- XNG has better maintainability and scalability
  - Development lifecycle oriented to ECSS E-40/Q-80
- XNG released as a SDK under a proprietary license

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XNG over GR740 current status

- XNG is currently available as a prototype
  - Prototype = fully functional non-qualified version
- ECSS qualification
  - XNG already qualified ECSS category B in other architectures
  - ECSS qualification in GR740 not in the fentISS' mid-term roadmap
  - To be addressed under a customer request
- No guest OS ported yet
  - To be addressed under a customer request
- Other processors
  - Support to the LEON5 processor and ECSS qualification in fentISS' long-term roadmap

THANKS!

FENT INNOVATIVE SOFTWARE SOLUTIONS S.L.
Ciudad Politécnica de la Innovación
Building 9B Office 1.67
Camino de Vera s/n
46022 Valencia, Spain
+34 963 294 704
info@fentiss.com

www.fentiss.com

Visit our website and follow us on social media!