Exploring LynxOS

What is LynxOS?

- Hard real-time operating system (RTOS)
- UNIX-compatible
- Full POSIX conformance (Portable Operating System Interface)—assures code portability between systems
- Multiprocessing
- Multithreaded

Why LynxOS is RTOS?

- Designed for absolute determinism
- Supports multiple applications with multiple interrupting devices

Usually used on information of sensitive nature

Hardware characteristics

Processor support:

- Motorola: PowerPC (PPC 601, 603, 604), PowerPC G3 (PPC 75x), PowerPC G4 (PPC 7400,7410,74xx) with Altivec Support, PowerPC IBM 405,440.
- Intel: x86(IA-32) Architecture (and compatible).
- MIPS
- Xscale
- ARM9

Kernel features

- Multitasking and multithreaded RTOS
- Complete MMU based protected address spaces for tasks
- Four scheduling policies (FIFO, Priority Quantum, Round-Robin, Non-preemptive)
- Configurable time quantum for priority levels
- Configurable tick timer resolution

Process management

- Uses a RT Global Scheduler
- implements priority inheritance and priority tracking
- Applies a uniform global priorities management
- Kernel threads may utilize 1/2 priority steps

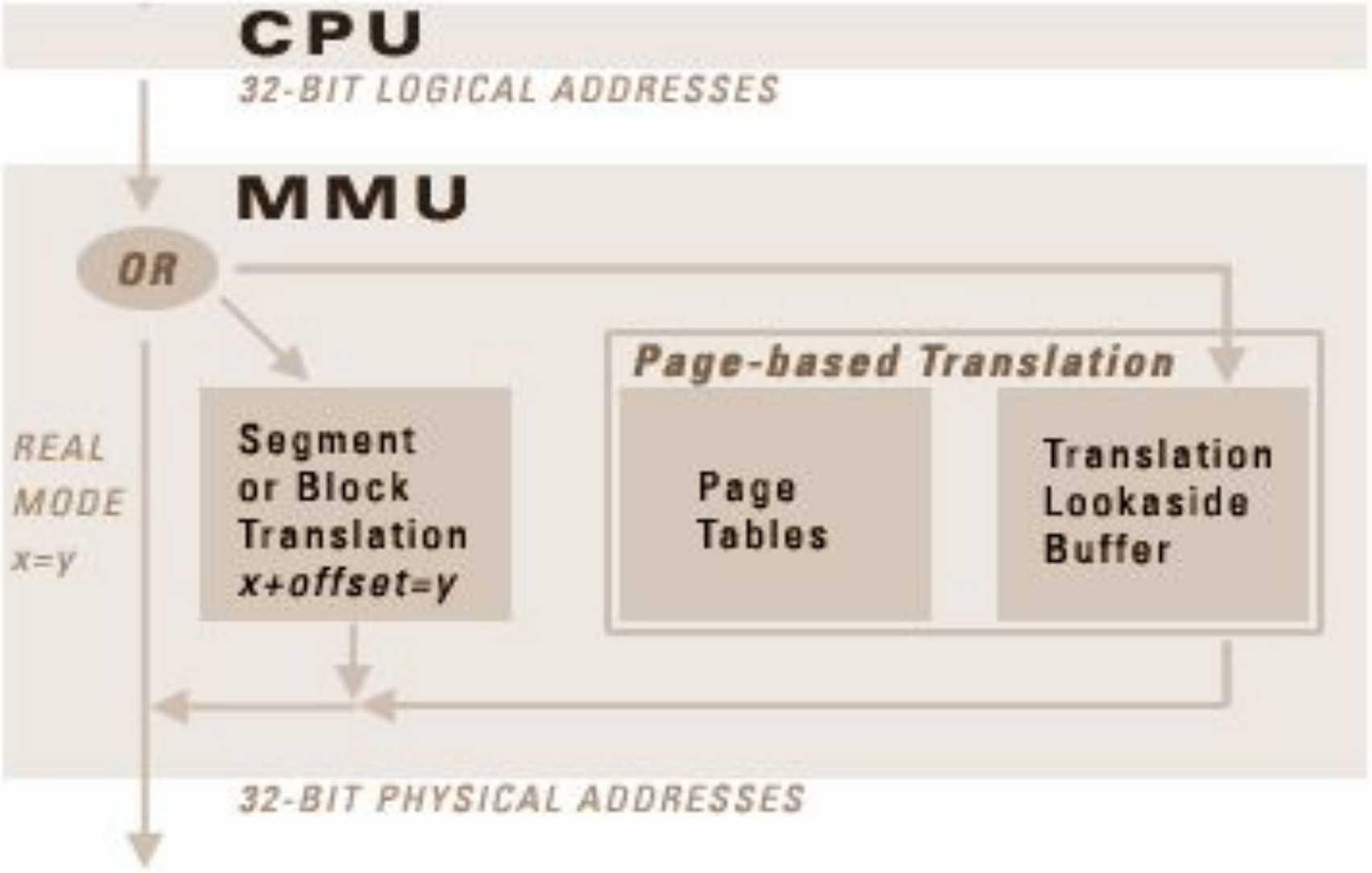
Scheduling policy

- SCHED_FIFO (first-in, first-out)
- SCHED_RR (round robin)
- SCHED_OTHER (Priority based quantum)

Memory management

- Conventional UNIX protections exist between application threads of different processes
- exploits very well hardware memory management unit (MMU) from processor

MMU design

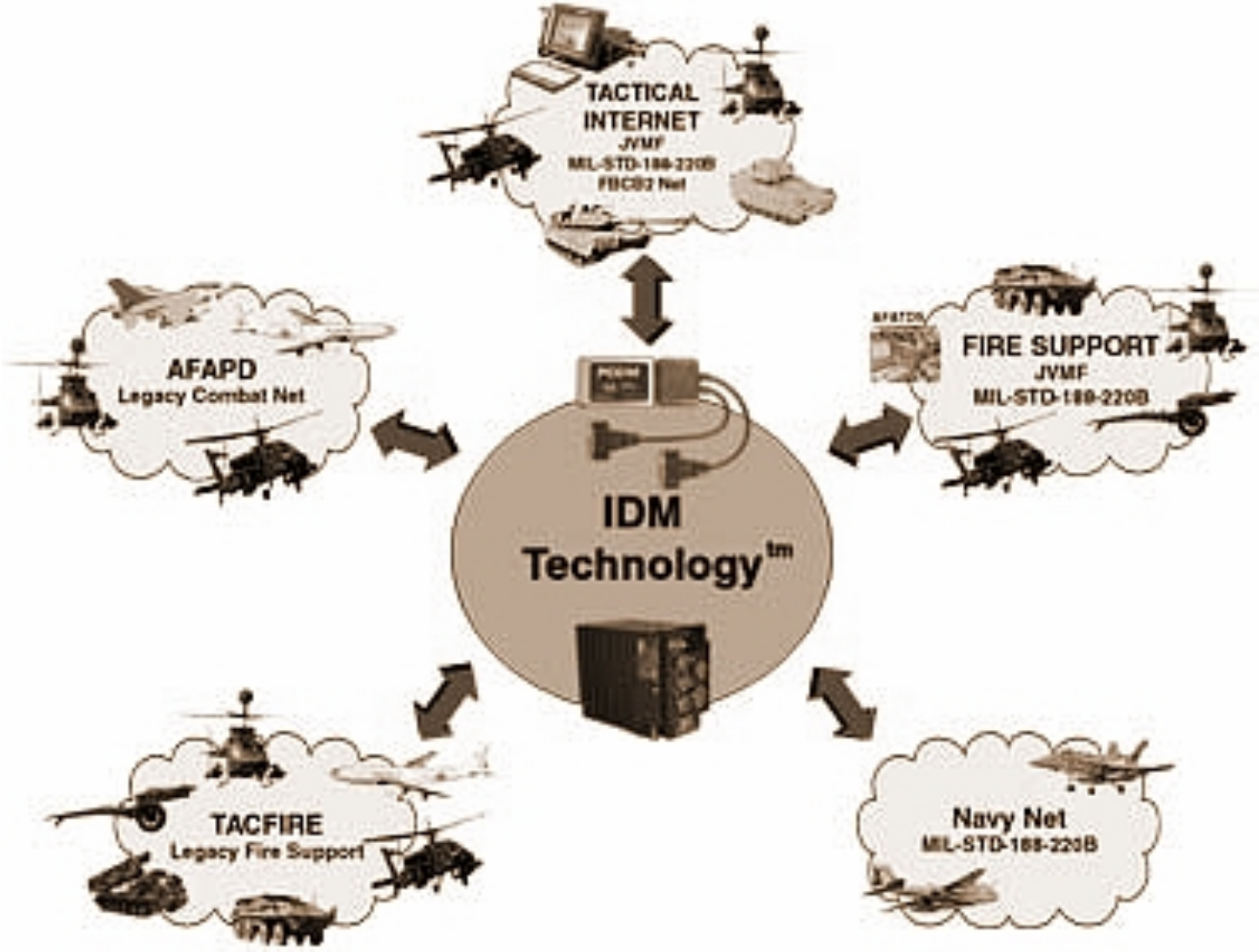

CPU
32-BIT LOGICAL ADDRESSES
MMU
OR
REAL
MODE
x=y
Segment
or Block
Translation
x+offset=y
Page-based Translation
Page
Tables
Translation
Lookaside
Buffer
32-BIT PHYSICAL ADDRESSES

Networking support

- Supported protocols: TCP, UDP, ICMP, IGMP, ARP, RARP, DHCP, NAT, RPC, NTPv3
- Network facilities supported are: DHCP, NTP, XNTP, OpenSSL, NFS, Samba
- Network device support: Gigabit Ethernet, 100baseT interfaces

Successful stories

- USPS has counted on Scio system and LynxOS to sort the country's mail for more than 10 years
- ICI's IDM (improved data modem) used by U.S Army and Air Force to communicate each other


TACTICAL
INTERNET
JVMF
MIL-STD-188-220B
FBCB2 Net
AFAPD
Legacy Combat Net
FIRE SUPPORT
JVMF
MIL-STD-188-220B
IDM
Technology™
TACFIRE
Legacy Fire Support
Navy Net
MIL-STD-188-220B

Conclusion

- LynxOS is the superior foundation for sophisticated real-time systems
- Open API
- Full POSIX conformance
- True Linux compatibility

VxWorks

Major Distinguishing Features

- Flat memory model
- Priority pre-emptive scheduling
- Multitasking kernel
- Interrupt-driven
- Tornado IDE
- Mutual exclusion via locking/semaphores
- Intertask communication with message queues
- Watchdog timers
- User-interface shell

Flat memory model

- No virtual memory or page swapping
- VX_VMI
- Each task has own context
- Single common address space

Priority pre-emptive scheduling

- “scheduler” software handles priorities
- Pre-emptive = forcibly removing tasks
- It is the default for VxWorks
- Highest priority task runs
- Round-robin scheduling

Interrupt driven

- Interrupts generated by an asynchronous event
- To perform context switches
- Service hardware/external signals
- Low latency

Mutual Exclusion

- To protect shared memory
- Provide exclusive access to resources
- Interrupt locks
  - to protect access to shared data structures between an interrupt handler and the thread that owns the handler
- Pre-emption disabling
- Semaphores

Message queues

- Task communication
- Client/server model
- Read, perform, reply

Watchdog timers

- Time delayed interrupts/function calls
- System clock