

symbian



# Symbian OS SMP

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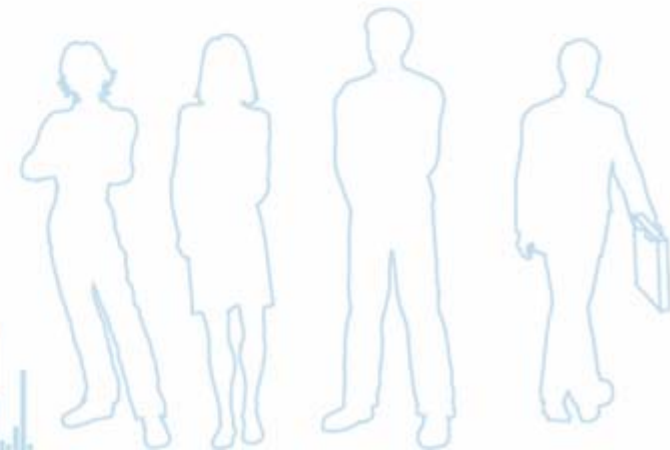
## SMP Opportunities and challenges

- Symbian OS
- Phone Hardware
- SMP-Safe Migration
- Power Management
- Test and Validation
- Backwards Compatibility Box
- Conclusion

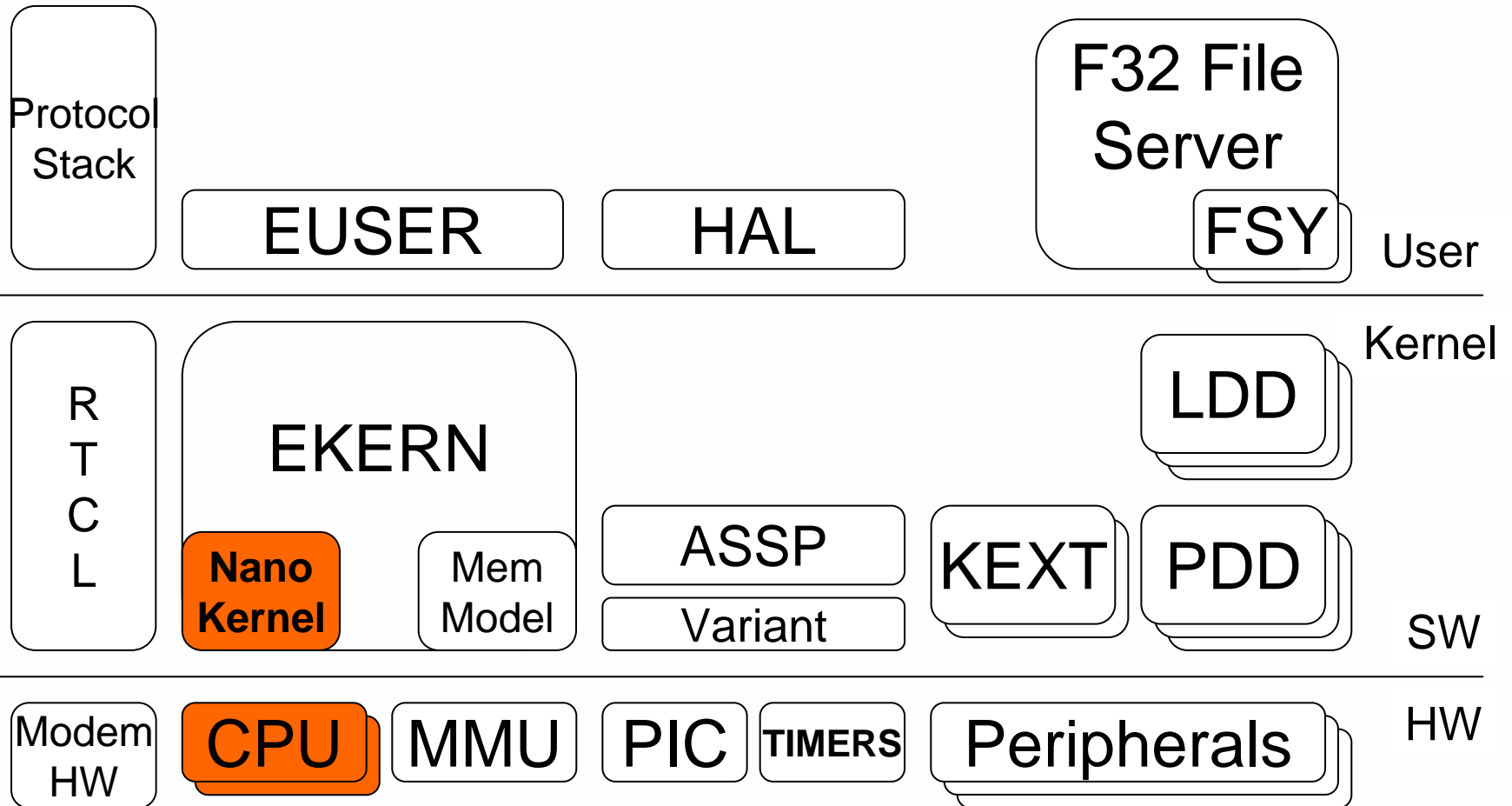


# Symbian OS

- Open OS, downloadable applications.
- 32bit, multitasking, memory protected, fully pre-emptive OS.
- Micro kernel with Real Time capability.
- System servers (F32, C32, WSRV...)
  - ... 70+ servers after boot.
  - ... 10+ simultaneously active, depending on use cases.
- Design for resource constrained devices
  - ... RAM, ROM and Battery power.
- SMP will deliver “Performance on Demand”
  - ... Rich web access. Non-optimised multimedia.
  - ... Super3G, 100Mbs downlink.



# Symbian OS, Nano Kernel



## Phone hardware

- PC experience and performance, from Cell phone battery
  - ... 1000mA/hr, 200 hours standby.
- 2xCortexA9, 600+Mhz
  - ... Within todays power budget, 8x todays ARM11 performance.
- 5-10% of SoC area for ARMs
  - ... slower homogeneous SMP ramp up.
- Remaining area of SoC contains Asymmetric Heterogeneous Multiprocessing and memories.
  - ... 3D Graphics, SVG
  - ... HD Video (Encode/Decode)
  - ... Camera ISP
  - ... Audio (migration to SW?)

## SMP-Safe

- Stable and correct OS operation on SMP.
  - ... Symbian programming model is helping migration.
- Descriptors
  - ... String classes, for ROM based contents. Bounds checked.
- Active Objects
  - ... Threads historically discouraged in favour of co-operative ActiveObjects.
  - ... Co-operative task sharing, with a single thread.
  - ... Active Scheduler waits on thread semaphore, then calls ActiveObjects
  - ... Safe access to local variables and memory.
  - ... Active Objects ~= state machine.
  - ... Therefore no deadlocks in most applications



# SMP-Safe

- Client Server for all system services.
  - ... F32, C32, WSRV, MMF, etc..
  - ... MMU protection between processes
  - ... IPC managed by kernel
  - ... Frameworks deal with all client interactions (creation, IPC, death etc)
- Threads
  - ... Threads used for adding synchronicity. Worker and loaders
  - ... RThread == pThread.
- Memory and Synchronisation objects:
  - ... RSemaphore, RMutex, RFastLock
  - ... RCriticalSection, TSpinLock, (Read and Write locks)
  - ... Publish and Subscribe.

## Device Drivers and Interrupts

- Device Drivers can be multithreaded today.
- Disabling interrupts is no longer global lock.
  - ... Need to replace with SpinLocks.
- nKern will distributed interrupts to available cores.
  - ... Interrupts migrations for load balancing.
  - ... Complex code due to start-up and shutdown of cores.



# Power Management

- Symbian optimised for power management.
  - ... Event driven system (no polling code)
  - ... Race to completion (Null Thread power management)
  - ... DVFS in use today, worth typically 30% in some use cases.
- SMP Fast & Narrow
  - ... Run CPU0 up to 100%, then enable CPU1 for 200%
  - ... Good for single threaded loads
  - ... Fast CPUs, High leakage
- SMP Slower & Wide
  - ... Run 2x CPUs at DVFS points, (30%, 60%, 100%)
  - ... Requires balanced work loads
  - ... Low leakage CPUs.
- Optimization choices, a mix of above.
  - ... Context Switch time  $\approx$  CPU wake up time (2+us)
  - ... Power management vs Affinity
  - ... Thread Migration vs Affinity

# Test and Validation

- Crazy Scheduler
  - ... Changed IPC and Synchronisation objects.
  - ... Simulated priority changes, decreased timeslices.
  - ... Crazy simulated hardware.
- SMP development tools
  - ... Debugger, Profilers
- Testing
  - ... System test for 1-4 CPU configurations.
  - ... NEC NaviEngine SoC
  - ... “SMP improves code quality”
- Systems integrations
  - ... Challenge is to get >100MBytes of dense code into a phone.

## Backwards compatibility box

- Symbian makes strong Binary Compatibility Promise.
  - ... 9.x versions are all compatible.
- Migration to SMP will retain
  - ... Binary compatibility and Source Compatibility.
- SMP migration will introduce
  - ... Behavioural Changes
  - ... Bug incompatibilities
- Compatibility box will limit:
  - ... Non SMP-Safe executables.
  - ... All processes threads tied into an affinity group.
  - ... Retain IPC bug compatibilities
  - ... Will come at some execution cost

## SMP on Symbian OS

- Migration of current OS to SMP is helped by existing OS choices.
  - ... Many servers (100+) with worker threads.
- Massive performance gains from SMP hardware need to be coupled with interesting power management choices.
  - ... Adaptive CPU shutdown.
- Existing software assets will be retained.
  - ... >10 Million lines of code.