

Modesto Novell's Road to IA-64 Computing

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Modesto IA-64* Outline

- Vision Statement
- Key Requirements
- Architecture
- Migration Strategy
- Tools Strategy
- Status
- ISV Opportunities
- Call to Action

* Third-party marks and brands are the property of their respective owners.

Modesto IA-64 Vision Statement

- **Start with an appliance**
 - ◆ Cross the chasm with a clear solution
 - ◆ Reduce project complexity
 - ◆ Follow on later with more appliances and general-purpose OS
 - ◆ First appliance is internet Cache, leverage ICS momentum
- **Leverage IA-64 for performance, scalability, and reliability**

Modesto IA-64

Key Requirements

- Deliver the project on time!
- High performance services engine
- High performance Java, protocol engine
- Fully exploit Itanium™ capabilities
- Good Foundation for Finite State Machine (FSM) structure
- Support the Novell security architecture
- Manageability
- Permit Quality of Service (QoS)

Modesto IA-64 Abstract Architecture

Programming environments:
Java and Non-Java

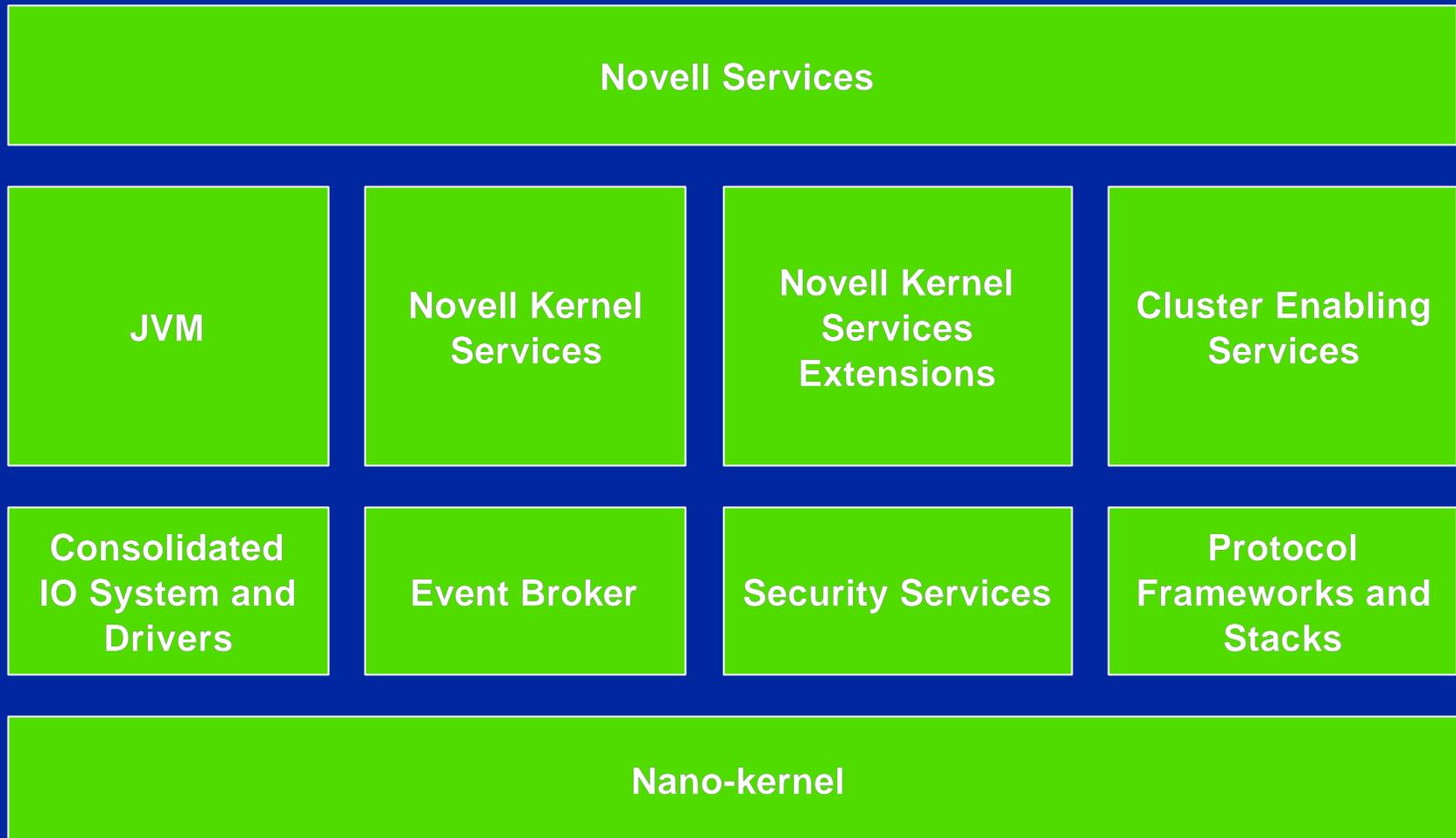
Other Infrastructure: I/O etc.

Nano-kernel
(Low level CPU, memory and
interrupt management)

Modesto IA-64 Architectural Principles

- Support each Programming Environment (PE) as efficiently as possible
 - ◆ Minimize abstractions
 - Nano-kernel abstracts hardware with minimal semantics
 - ◆ Each PE implements the abstractions it needs
 - Avoids semantic re-mappings
- Coarsely multiplex hardware resources

Modesto IA-64 Architectural Components



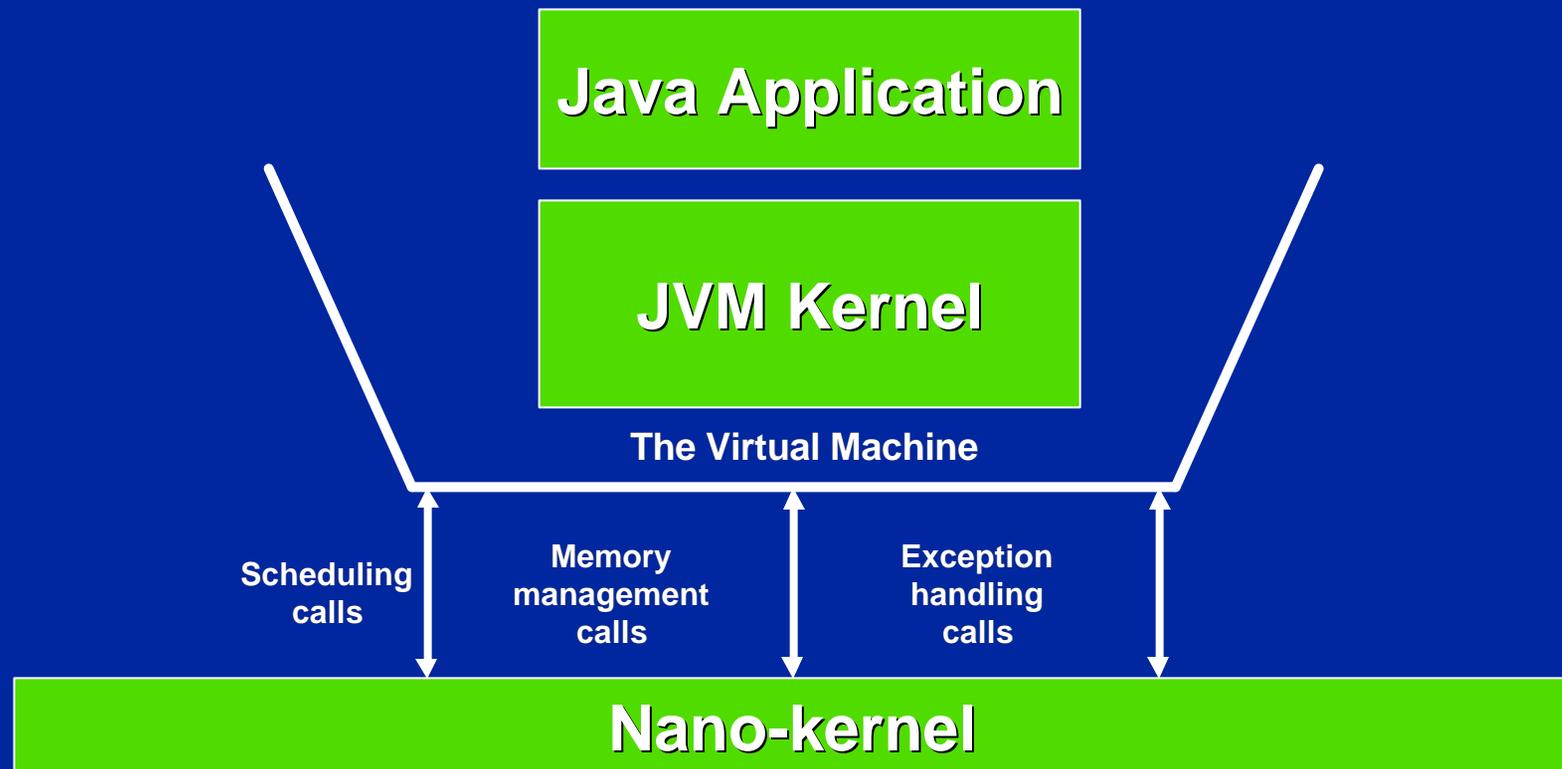
Modesto IA-64 Nano-kernel

- Primitive execution environment (virtual machine/strands)
- Low level memory management
- First level handling of hardware events (interrupts and exceptions)
- Resource management among virtual machines
- Booting and System Registry

Modesto IA-64 Execution Environment

- The Virtual Machine (VM) abstraction
- The Strand abstraction
- VM Scheduling
 - ◆ Nano-kernel switches control between VMs
 - ◆ Choice of VM scheduling policies
- VM specific exception handling

Modesto IA-64 Virtual Machine



Modesto IA-64 Virtual Machine (cont.)

- **A shared memory multiprocessing environment**
 - ◆ Execution contexts within a VM share the address space
- **Customizable programming environments**
 - ◆ Scheduling, exception handling and memory management can be customized

Modesto IA-64 Strand Abstraction

- **Customization of execution contexts**
 - ◆ The needed semantics can be layered
- **The containing VM schedules the strand**

Modesto IA-64 Virtual Memory

- Single address space scheme
- Efficient management of mapping structures and the translation look-aside buffer (TLB) cache
- Near zero-weight context switching (with respect to memory context)

Modesto IA-64 Consolidated I/O System

- Object based I/O manager
- Normalized access to diverse I/O resources
- Common driver architecture
- Support for channel-attached I/O frameworks as they become available
 - ◆ Next Generation I/O (NGIO)
 - ◆ Future I/O

Modesto IA-64 LAN Protocol Framework

- Zero-copy framework
- Load distribution at the connection granularity
- Optimized buffer management

Modesto IA-64 Event Broker

- **Kernel support for structuring a service as a finite state machine (FSM)**
 - ◆ Execution context management
 - ◆ Concurrency management
 - ◆ Manages notifications and cancellations

Modesto IA-64 Java Virtual Machine

- Integrate our JVM with highly optimized run-time tailored to the nano-kernel
- Working with Intel and Sun
- Provide Novell Java run-time extensions
- Integrate garbage collection and memory management
- Map to native synchronization primitives

Modesto IA-64 Novell Kernel Services API

- High performance non-java execution environment with portable interface
 - ◆ Natively hosted by nano-kernel
 - ◆ Sustains high performance services
 - ◆ Compilable for 64 or 32 bit environments
 - ◆ P64 data typing model
 - ◆ Services migration bridge to the new platform

Modesto IA-64 Developer Environments

- **Novell Kernel Services (NKS)**

- ◆ NKS hosted natively on Modesto
- ◆ NKS preferred on NetWare 5 for SMP development
- ◆ Migrate to new APIs on NetWare 5, then recompile for Modesto IA-64

- **Java**

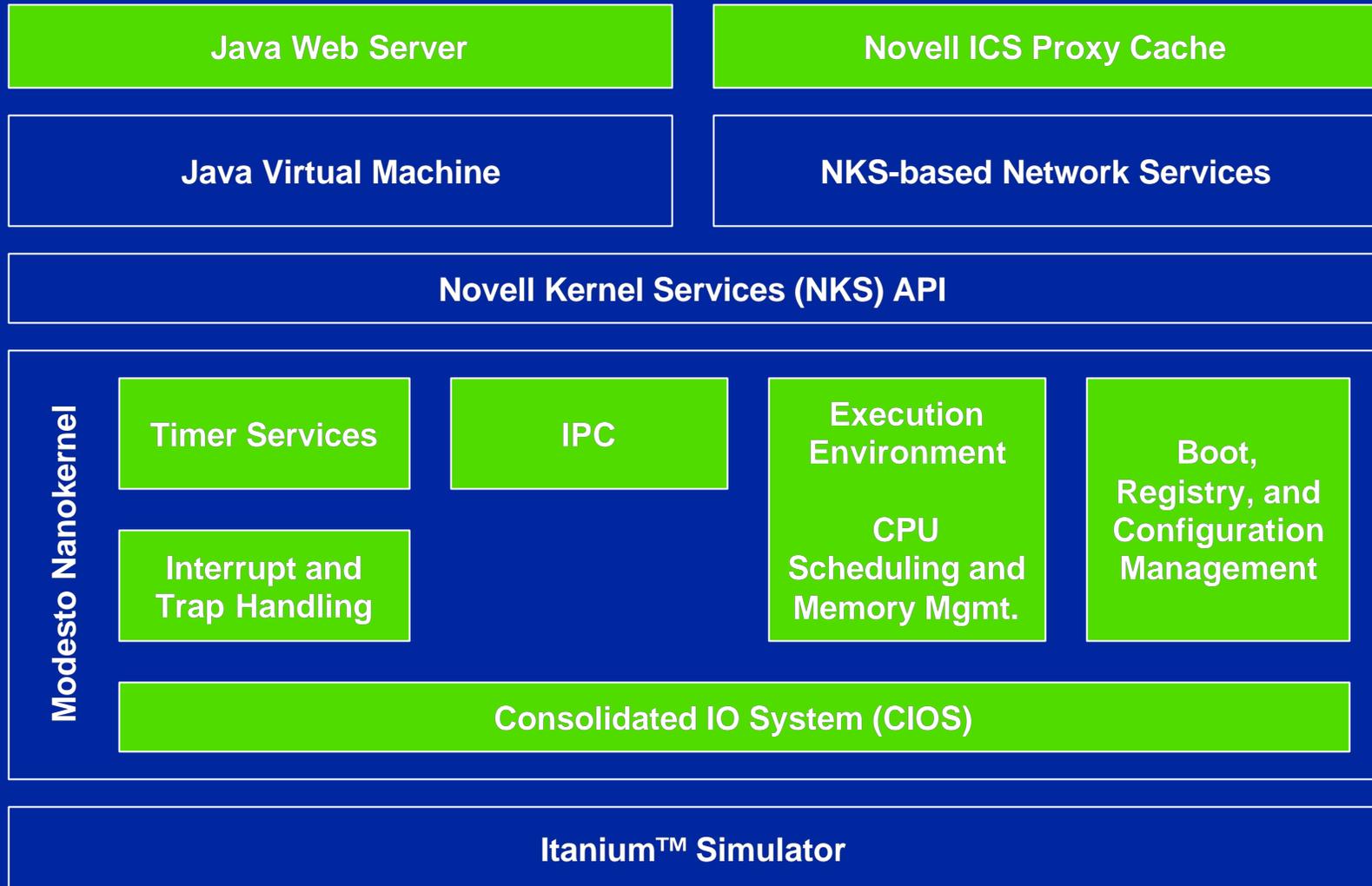
Modesto IA-64 Tools Strategy

- Tool set: Compiler, IDE, debugger, static code analysis (e.g. lint), ...
- Initially, EPC will be the primary tool vendor
- Additional tool vendors will be supported when available
- Modesto will support multiple object formats

Modesto IA-64 Status

- Proxy Cache is currently executing on Modesto IA-64
- NetFire JVM has been ported to Modesto IA-64

Modesto IA-64 Demo Architecture



Modesto IA-64

Key Characteristics

- High performance
- Directory enabled management
- Highly customizable and modular
- Highly reliable
- First product offering is the 64-bit Internet Caching System

Modesto IA-64 Deployment Scenarios

- High capacity Internet caching and content management
 - ◆ Proxy cache for Web users
 - ◆ Reverse proxy for Web publishers

Modesto IA-64 ISV Opportunities

- ISV opportunities follow first project

Modesto IA-64 Call to Action for ISV's

- Prepare your applications for 64-bit today
- Continue to work with Novell on availability of tools and interfaces
- Engage Novell on possibilities for integrated vertical solutions

Modesto IA-64 Contacts

- **Collateral, Press Releases, White Papers**

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