Unified Device Management via Java-enabled Network Devices

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Agenda

- Unified Management for Unified Networks
- Openness - Virtual community development, Domain experts
- Open Service Interface - values
- Architecture and technology concepts
- Strong security
- Java SNMP MIB API
- Summary

Purpose

- To introduce the new Open Networking Architecture that is based on Java-enabled Network Devices
- To enable easy 3rd party integration

Unified Management for Unified Networks

O B J E C T I V E

- Unified management

S O L U T I O N

- Java “Optlets” on all devices
  Security and Directory

B E N E F I T S

- Java-enabled Network Devices

Java on all devices
Unique value of Java

Unified Management

Community openness

- Success stories by large community of developers
- Net-based developers' communities
  - Linux, GNU, Apache, BSD, X-Windows, Perl, Tk/Tcl
  - Netscape browser, NFS, JDK, JVM
- Linux everywhere:
  - Compaq, HP, IBM, SUN and SGI.
  - Intel, Sparc64, Alpha, PowerPC
- The Web changes everything
  - Java, XML, E-Business

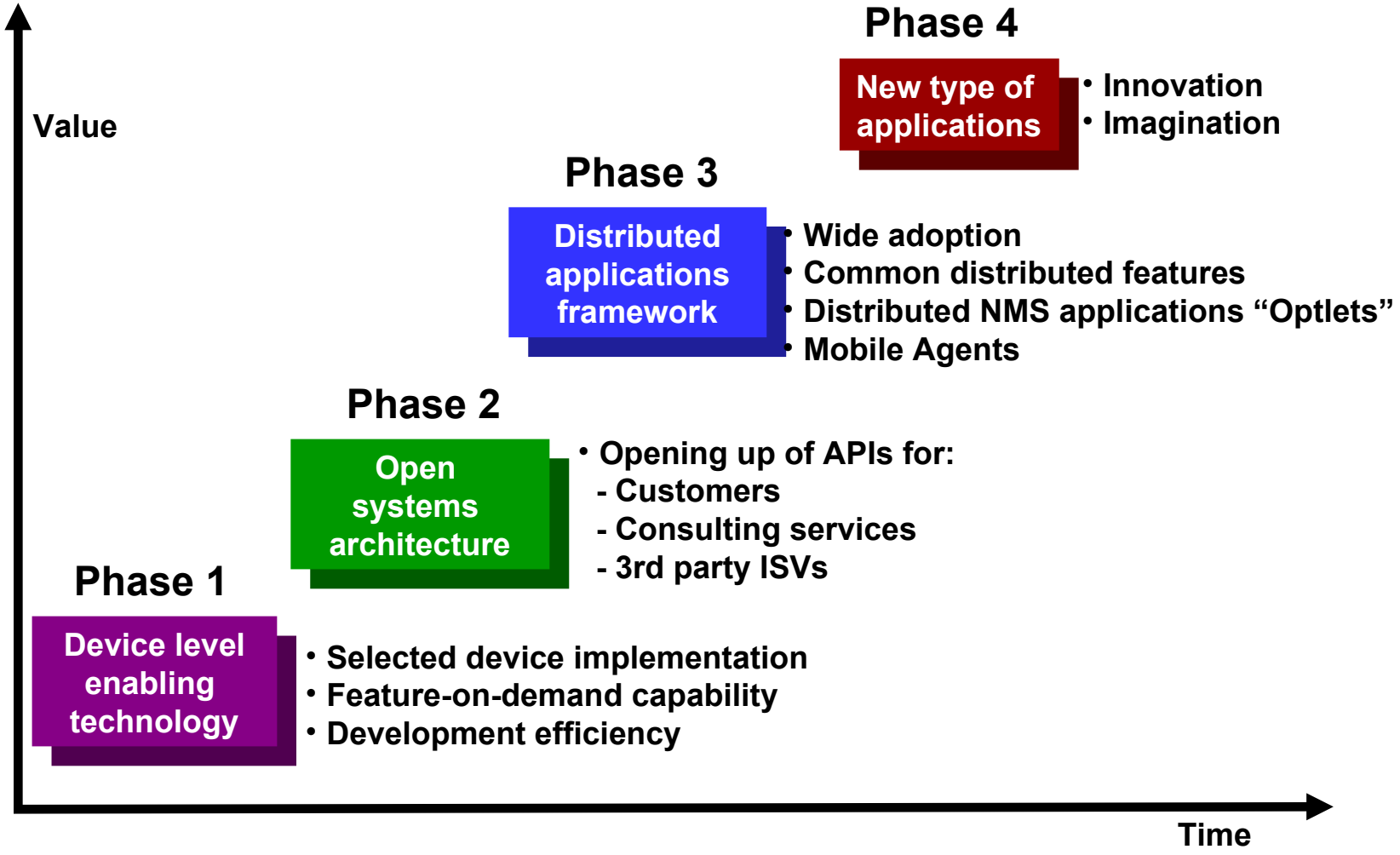
Open Service Interface - value propositions

- An open device software architecture enabler that:
  - reduces development cost by enabling cross-platform development
  - improves TTM through “feature-on-demand” capabilities
  - increases product differentiation by allowing incremental customization of products

Open Service Interface - value propositions

- An open device software architecture enabler that:
  - enhances scalability and flexibility for distributed deployment of management and IP services
  - facilitates innovation by opening network devices to third party developers
  - provides incremental revenue through potential consulting/ customization services

Open Service Interface - levels of adoption



Java-enabled Network Devices

- **What we have accomplished:**
  - **Java-enabled Device Architecture**
  - **JVM for Routers and Switches**
  - **JVM for network devices**
  - **Others – Optical network devices, OC-192**
  - **Java SNMP MIB API**
    - **include proxy mode for devices with no JVM,**
    - **Java interface to Cisco routers - COOOOOL !!**

Technology concept “Reversed Applets”

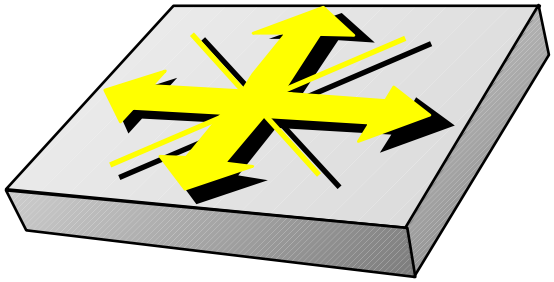
Applet

Web Server

Web Browser

The JVM is in the Browser

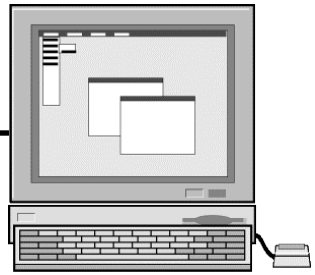
Technology is based on the concept of Reversed-Applets



Java Beans

Optlets

Reversed Applets



The JVM is in the Device

NMS

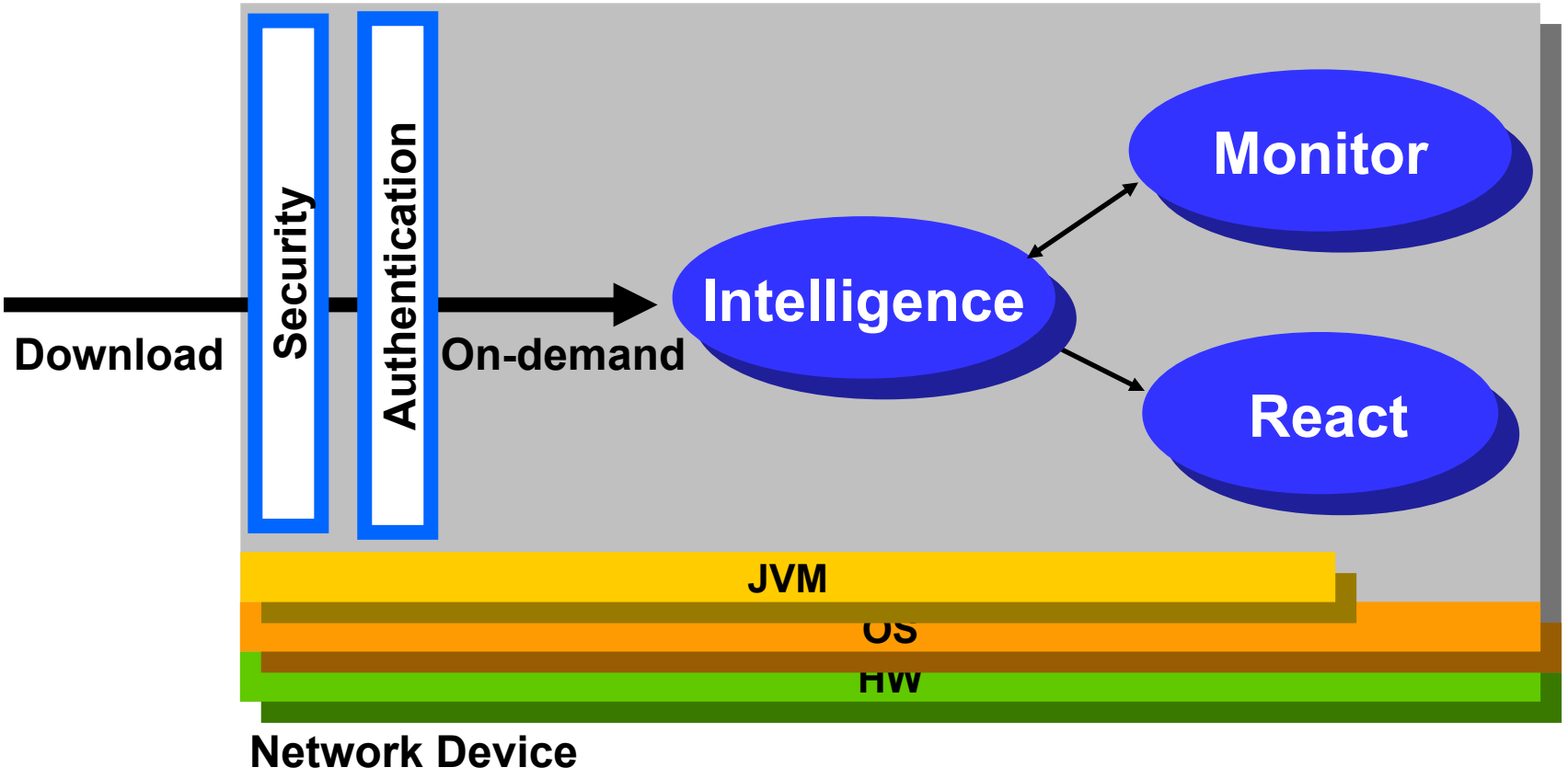
Potential applications

- "Feature-on-demand" for devices
- New class of system level Optivity applications in the form of distributed "Optlets"
  - characterized by system applications that require intensive interaction between NMS and device and/or across multiple devices
  - potential applications are topology, design analysis, diagnostics, policy implementations

Benefits and value

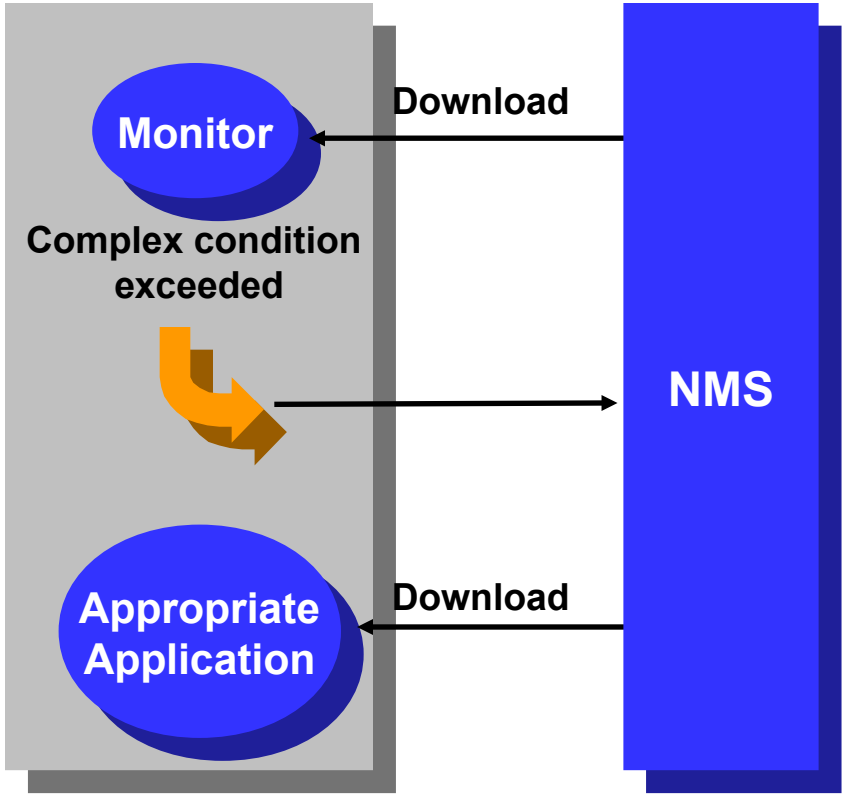
- Enabling component of a new intelligent network architecture
  - distributed applications-on-demand
  - component of AI (artificial intelligence) enabling infrastructure
  - roaming diagnostics and self-healing capabilities
  - built-in support for open industry ISV support

Example - Local Intelligence

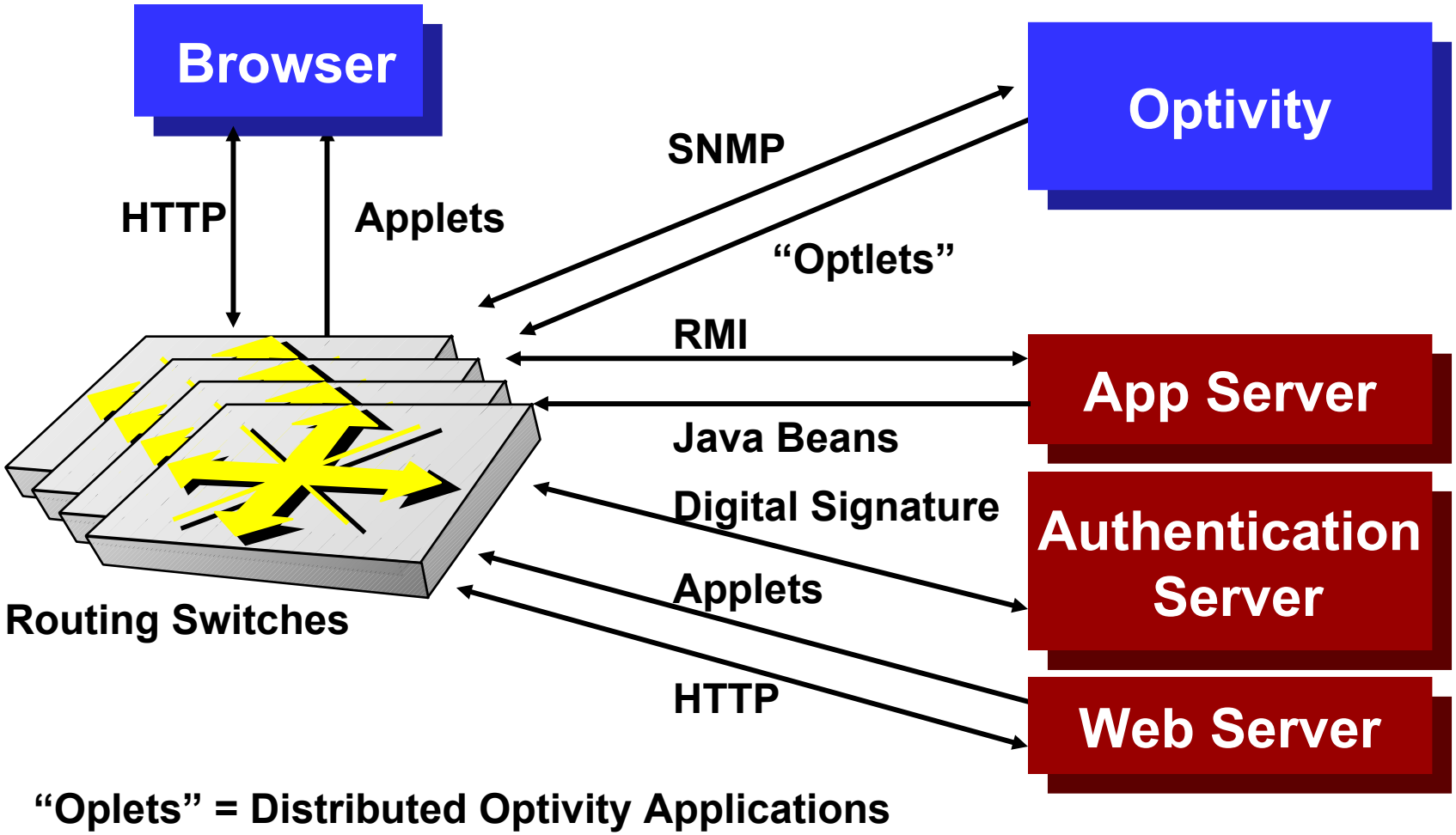


Application example

- Download Intelligent Agent Monitor from NMS to the device
- Wait for threshold
  - might be complex conditions
- Send “condition exceeded” event to NMS
- Automatic download appropriate application
- Application takes action

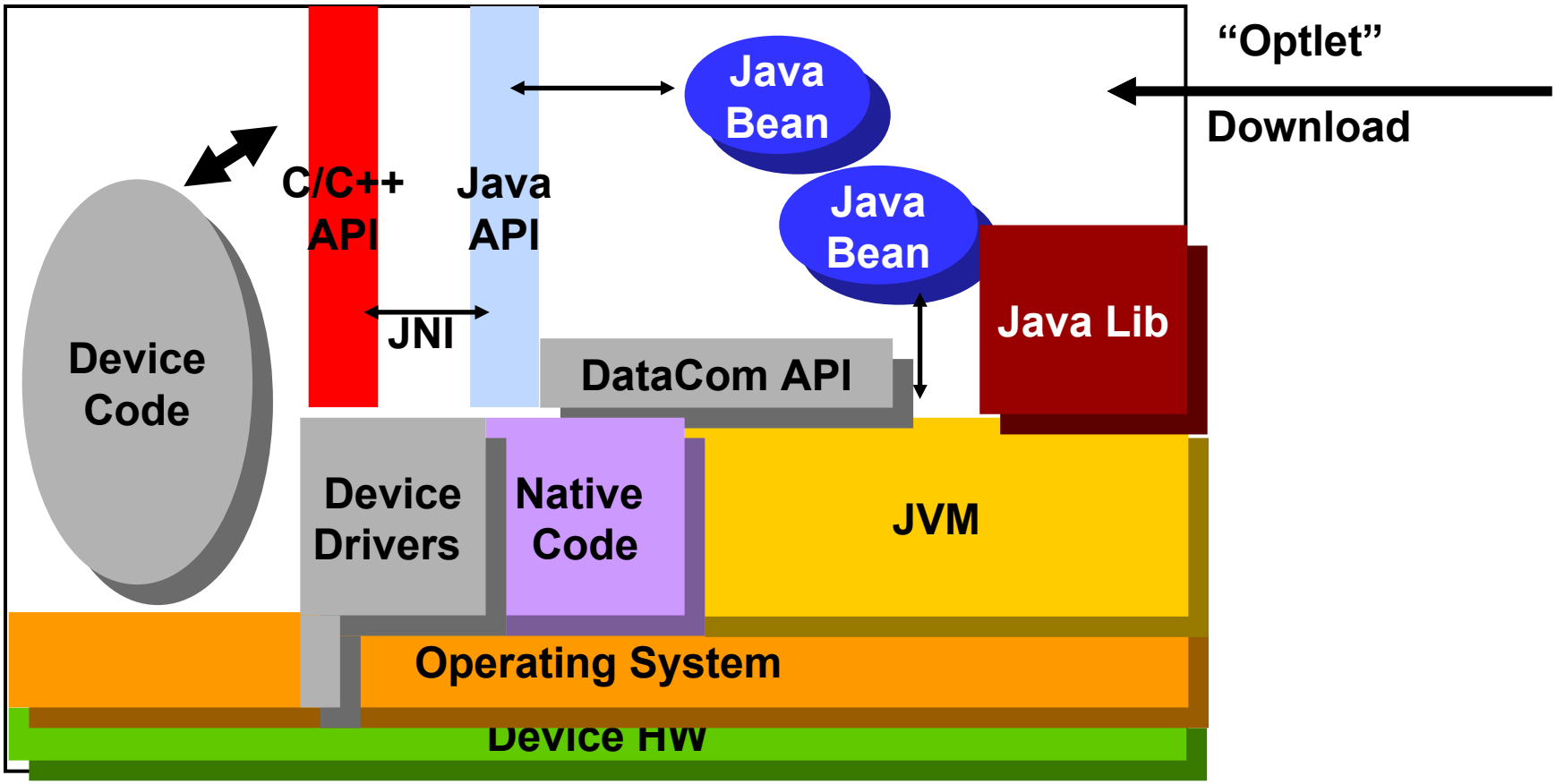


System architecture

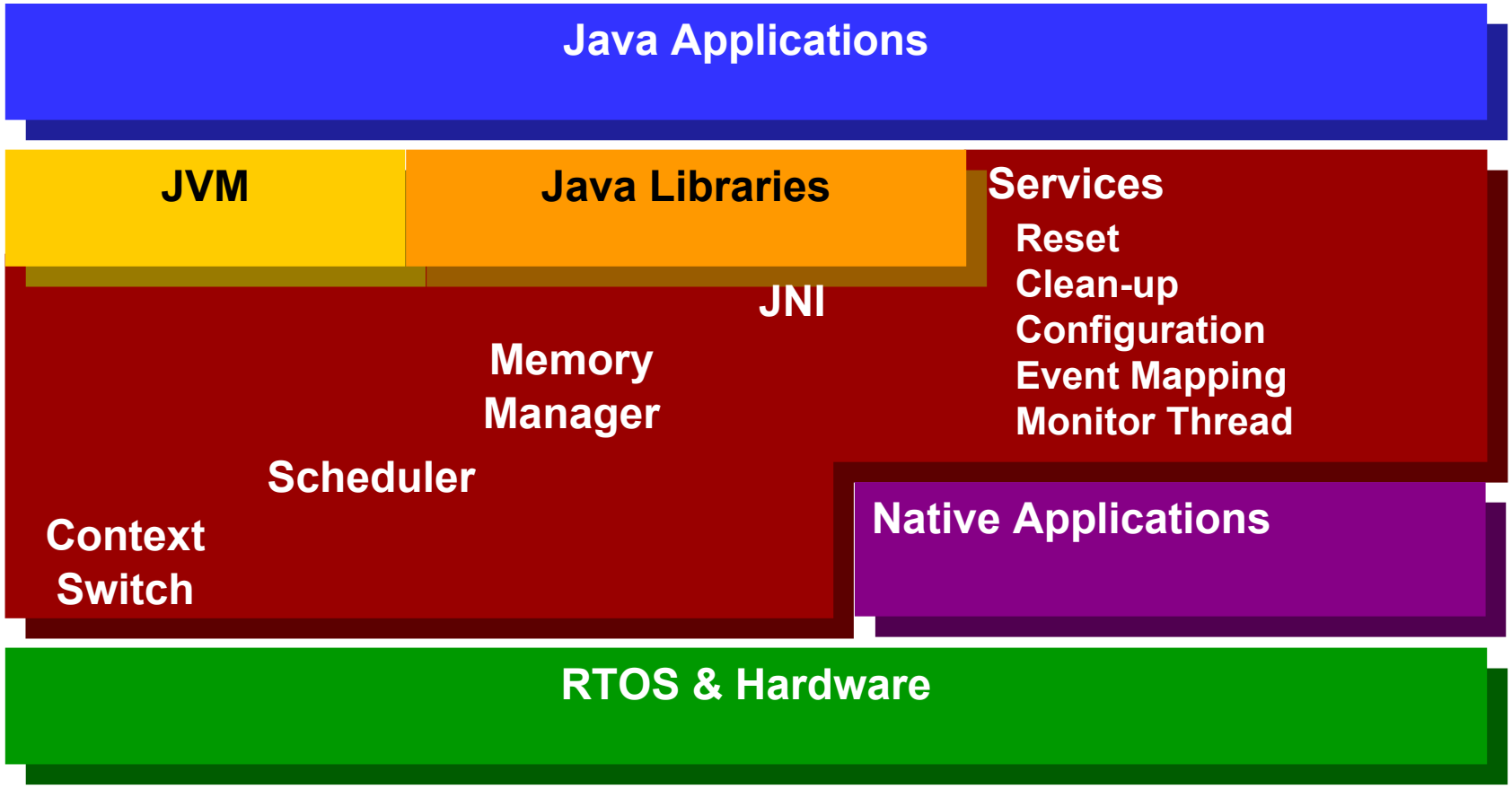


"Oplets" = Distributed Optivity Applications

Open Device architecture



JSCP system diagram



Strong security in the new model

- The new concept is secure to add 3rd party code to network devices
  - digital signature
  - “Certified Optlet”
  - no access out of the JVM space
  - no pointers to harm the work
  - access only to the published API
  - verifier - only correct code can be loaded
  - class loader access list
    - different Optlets with different access levels
  - JVM has run time bounds, type, and executing checking

Old model security (C/C++)

- Old model - not secure to add 3rd party code
  - not recommended to add 3rd party code to network devices
  - dangerous, C/C++ pointers
    - can touch sensitive memory location
  - risk: memory allocations and free
    - allocation without freeing
    - free without allocation (core dump !!!!)
- Limited security in SNMP

Java SNMP MIB API

- Portable across a range of network devices
- Extensible
- Simple and convenient for client use
- Consistent with SNMP model
- Hide unnecessary SNMP details
- Permit optimized access
- Re-use MIB documentation

MIB API generation

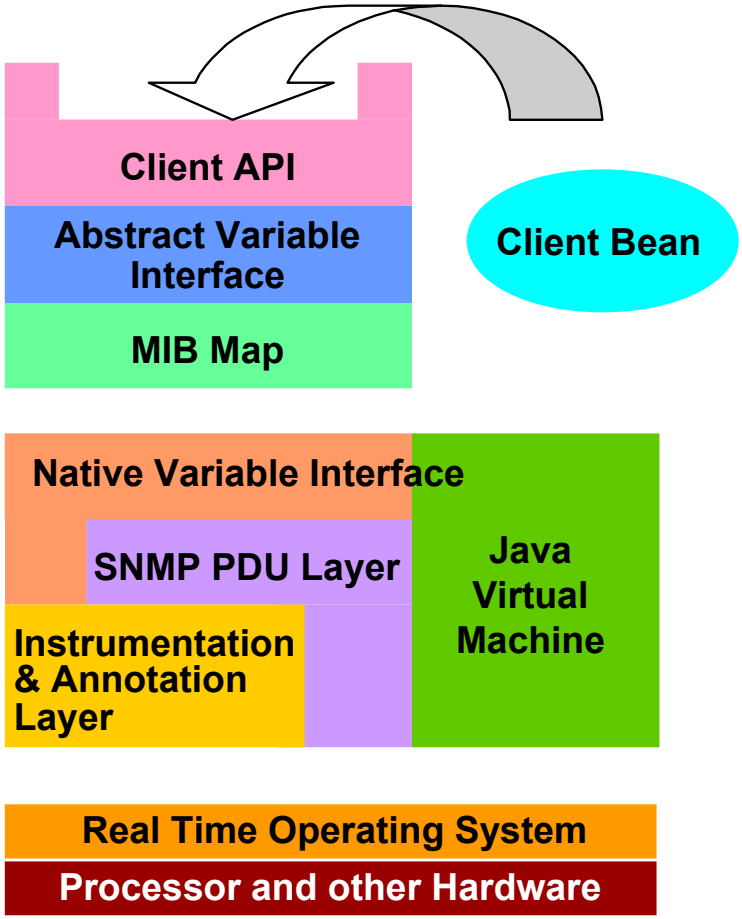
- Most of the Java code is generated automatically
- ASN.1 MIB definitions are converted into Java classes
- Documentation and commentary in the MIB definitions is placed as Javadoc formal comments
- HTML documentation generated from Javadoc

MIB objects

- The MIB data model is structured as a tree
- API represents MIB groups with Java classes
- MIB variables are represented with accessor methods
- Conceptual tables are represented with iterators
- API converts SNMP data values into standard Java types

JSNMP MIB API architecture

- API uses a MIB Map to dispatch requests to variable access routines
- Different parts of the MIB tree can be serviced by different mechanisms
- Two main schemes:
  - an ad hoc interface to the SNMP instrumentation layer
  - a generic SNMP loopback

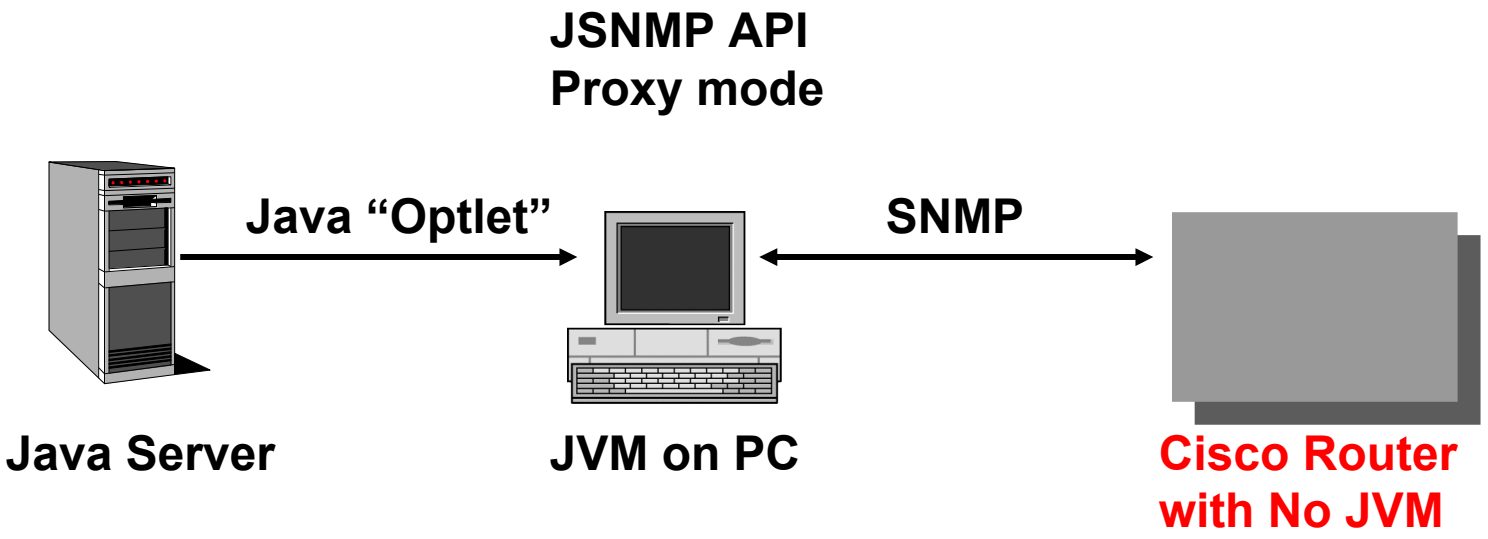


Advantages of MIB map

- Allows immediate generic implementation of the entire MIB via the loopback scheme
- Enables optimized native implementation of key MIB variables for maximum efficiency
- Permits definition of pseudo-MIB variables for extending MIB dynamically
- Provides site for centralized access management

Java MIB API - proxy mode

- Uses SNMP loopback mechanism to target a remote network element
- API can be used to control devices that don't have an embedded JVM



Summary

- Openness - successfully proven paradigm
- Domain experts - virtual community
- Allows innovations and added value

- Dynamic agents vs. static agents
- Dynamic loading
- Strong security
- An enabling-technology

Take it, and make it work for you