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

Unified Management

OBJECTIVE

Unified management

SOLUTION

Java “Optlets” on all devices
Security and Directory

BENEFITS

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

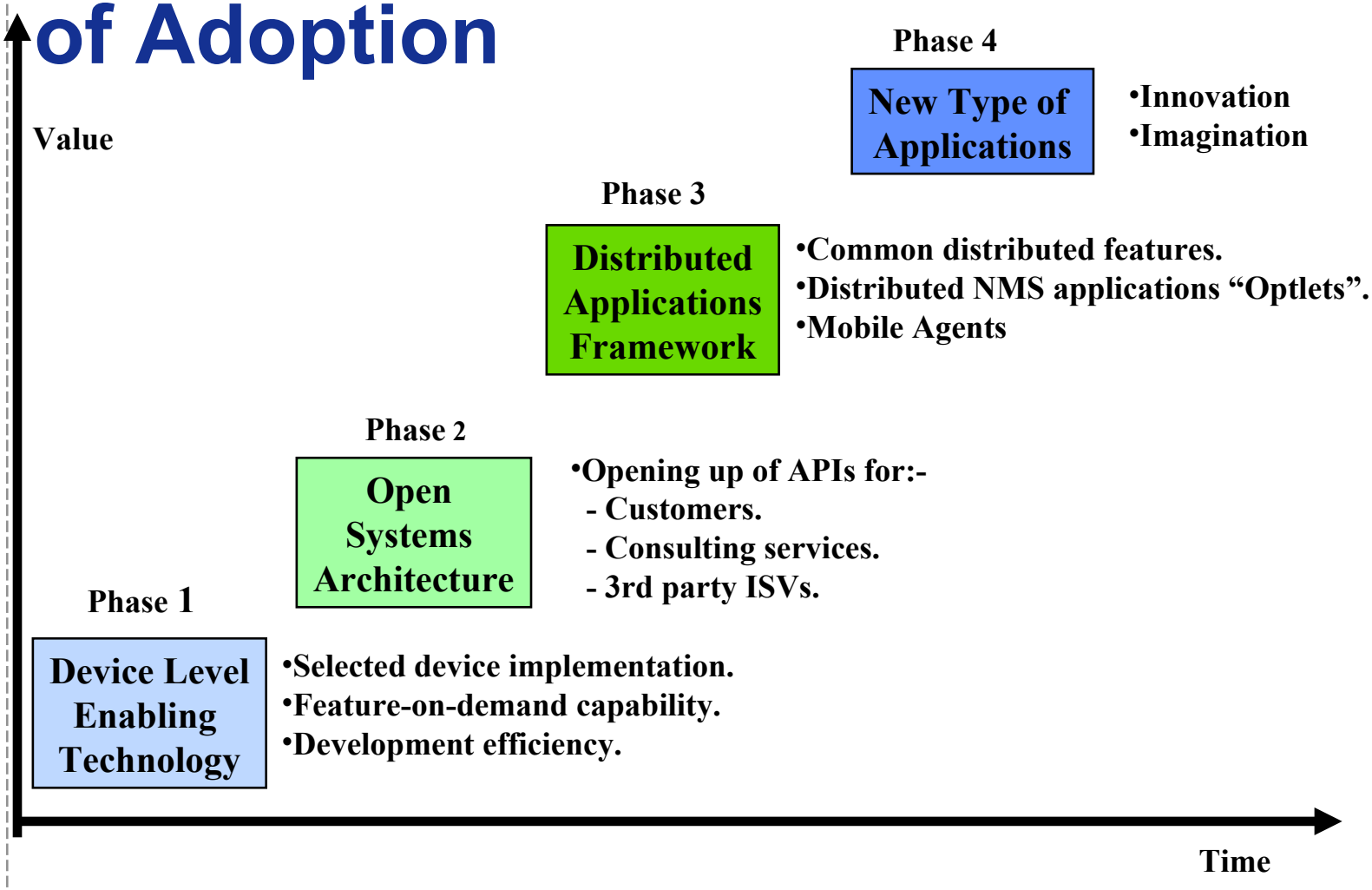
Open Service Interface - Value Propositions

- **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 Cont.

- **An open device software architecture enabler that:**
  - ***Enhances scalability and flexibility*** **for distributed deployment of management and IP services.**
  - ***Facilitates innovation*** **by opening devices to third party developers.**
  - ***Provides incremental revenue*** **through potential consulting/ customization services.**

Open Service Interface - Levels of Adoption



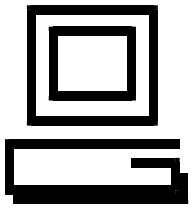
Java-enabled Network Devices

- **What we have accomplished:**
  - **Java-enabled Device Architecture**
  - **JVM for Switch, Router**
  - **JVM for Network device**
  - **Java SNMP MIB API**
    - **include proxy mode for devices with no JVM,**

Technology Concept
"Reversed Applets"

Web Server

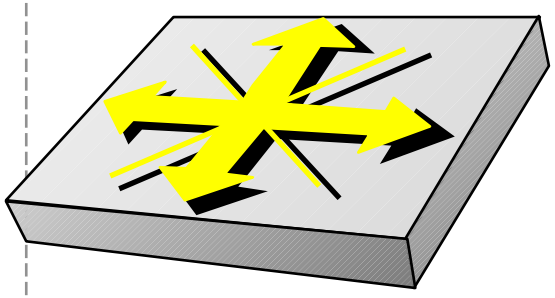
Applet



Web Browser

The JVM is in the Browser

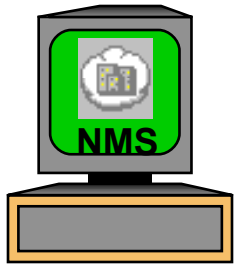
Technology is based on the concept of Reversed-Applets



Java Beans

Optlets

Reversed Applets



The JVM is in the Device

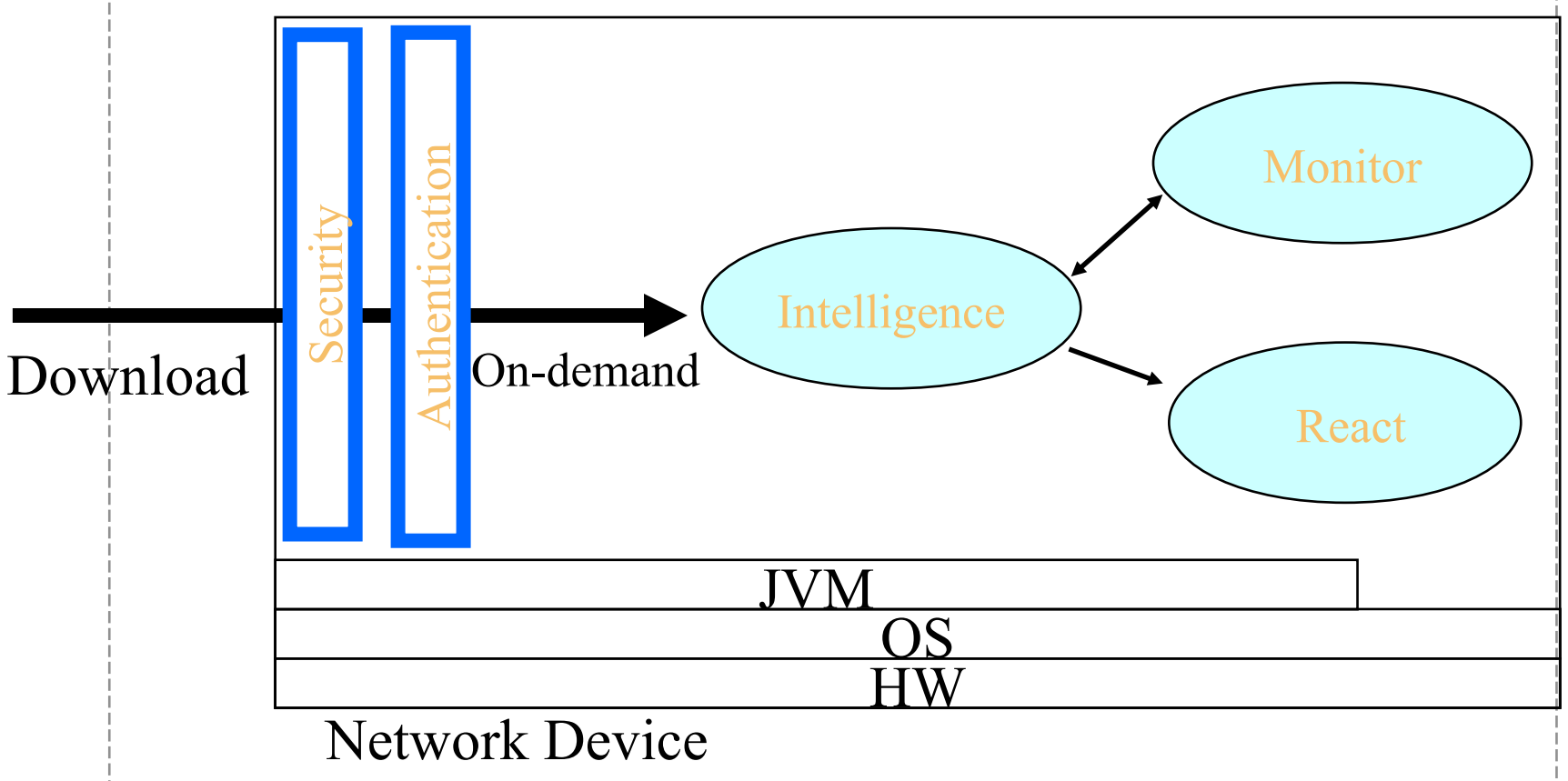
Potential Applications

- "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

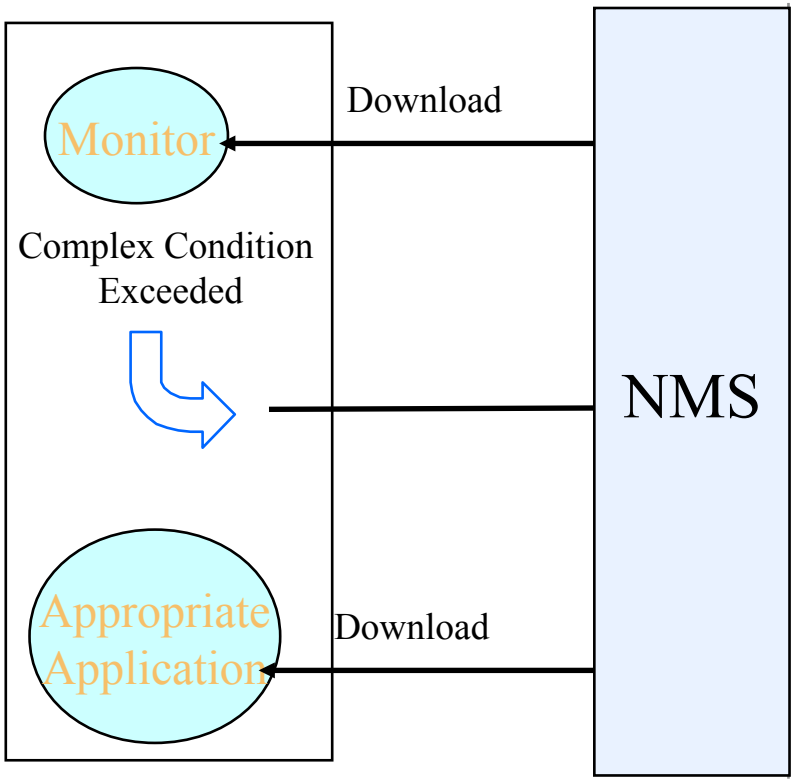
- **Enabling component of a new intelligent network architecture**
  - **Distributed applications-on-demand.**
  - **Component of AI (artificial intelligence) enabling infrastructure.**
  - **Roaming diagnostics and self-healing capabilities.**
  - **Built-in support for open industry ISV support.**

Example - Local Intelligence

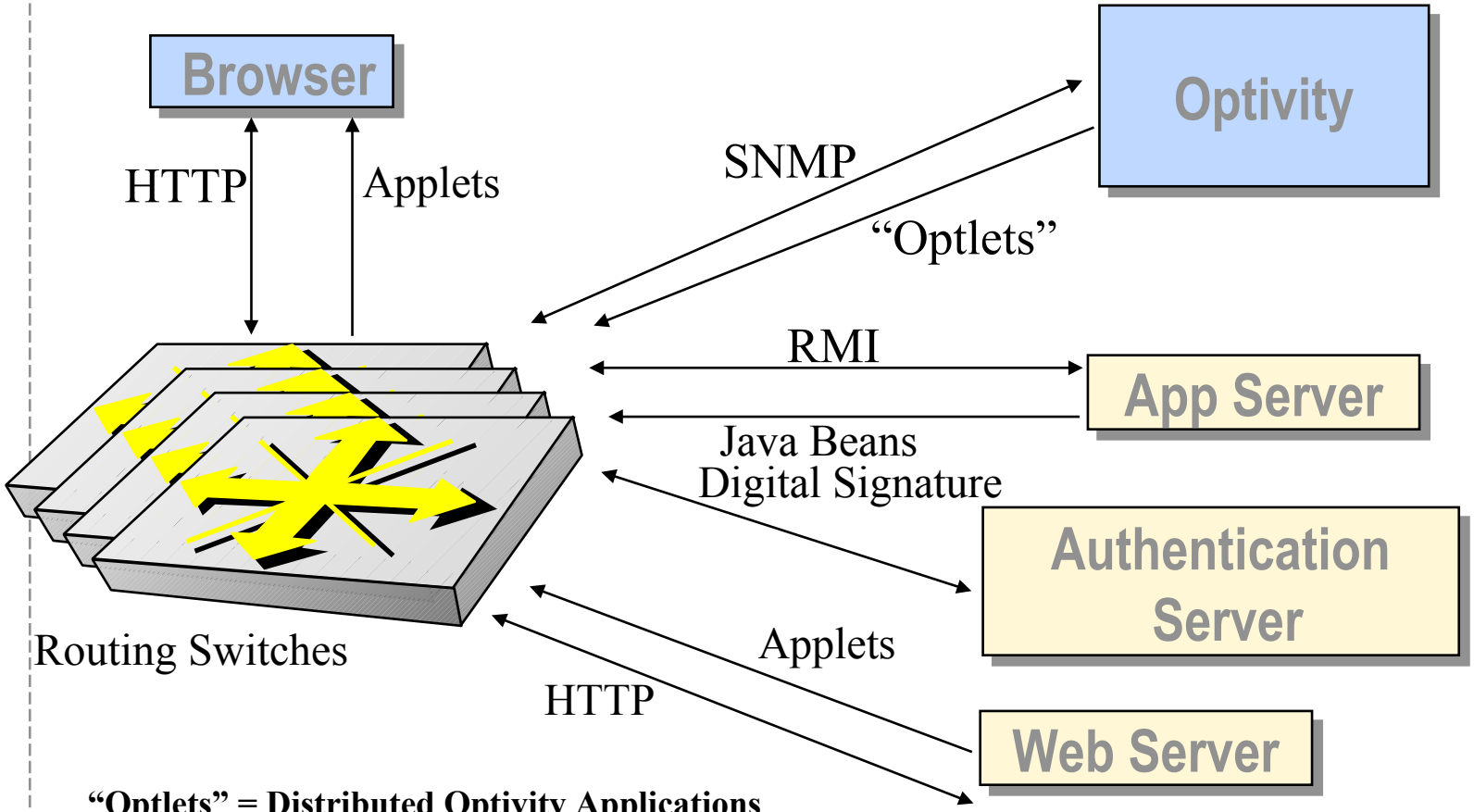


Application Example

- 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.

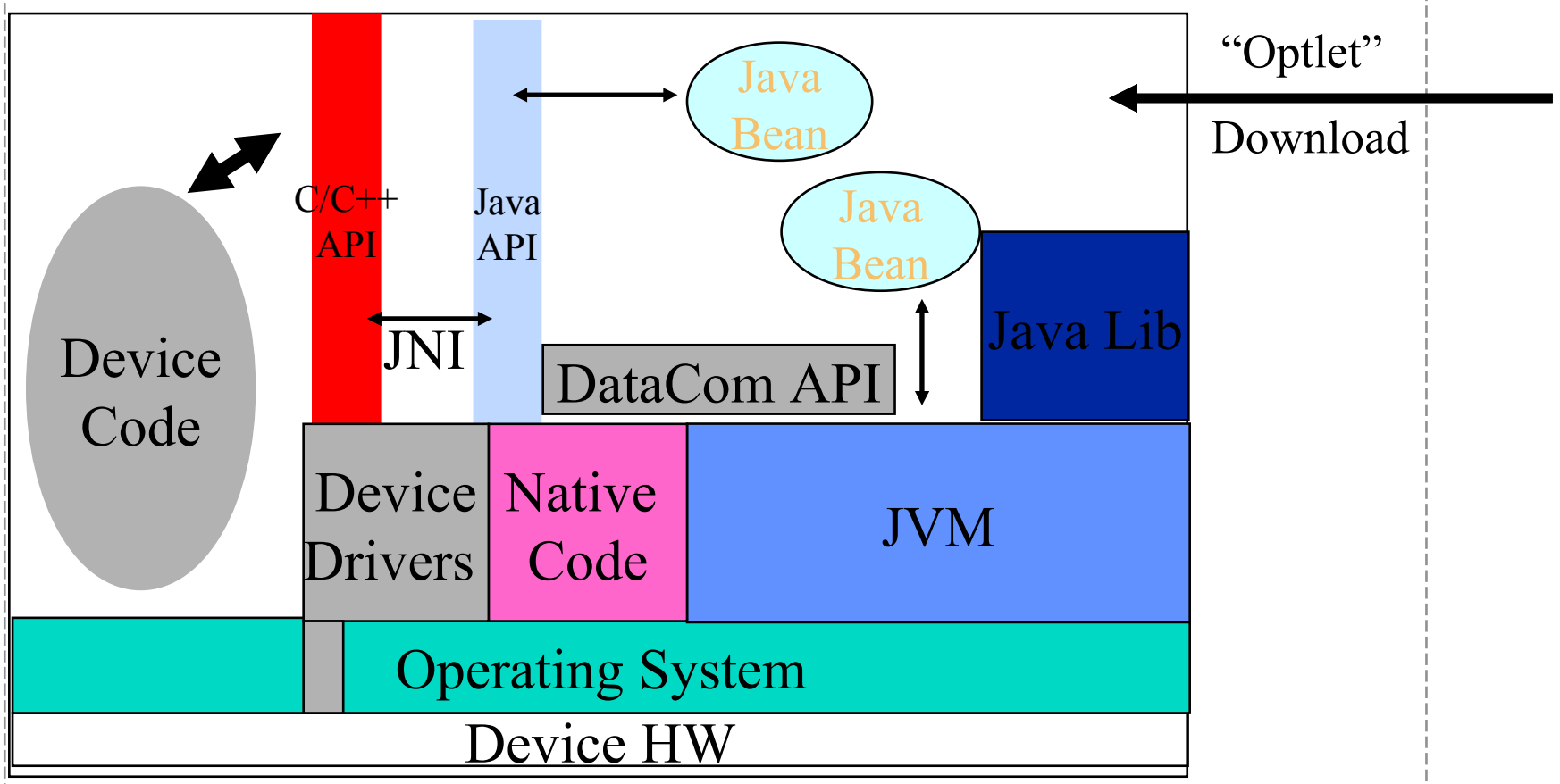


System Architecture

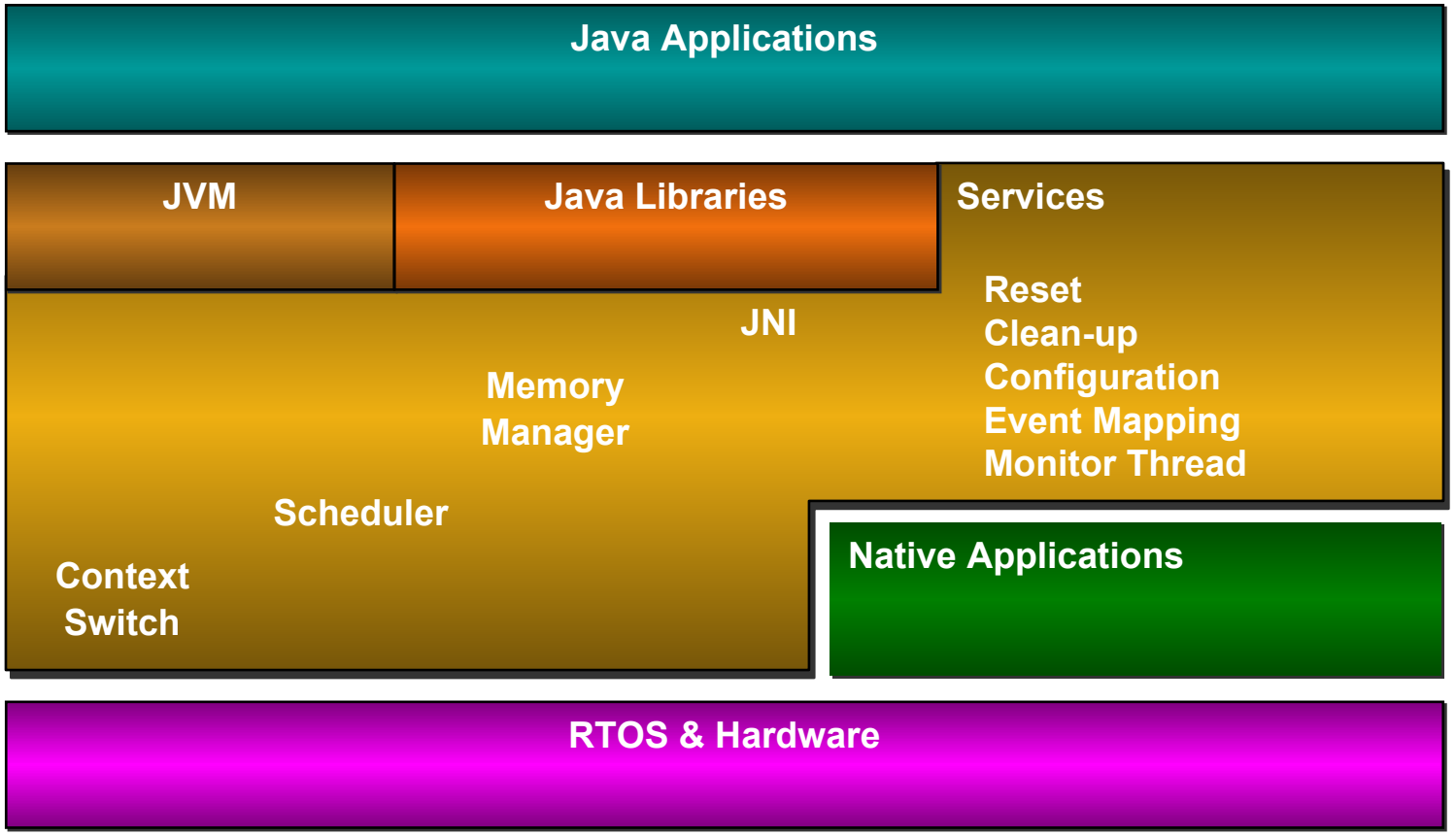


"Optlets" = Distributed Optivity Applications

Open Device Architecture



JSCP System diagram



Strong Security in the new model

- The new concept is secure to add 3rd party code to Nortel devices
  - Digital Signature
  - Nortel “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 Optles 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**
  - **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

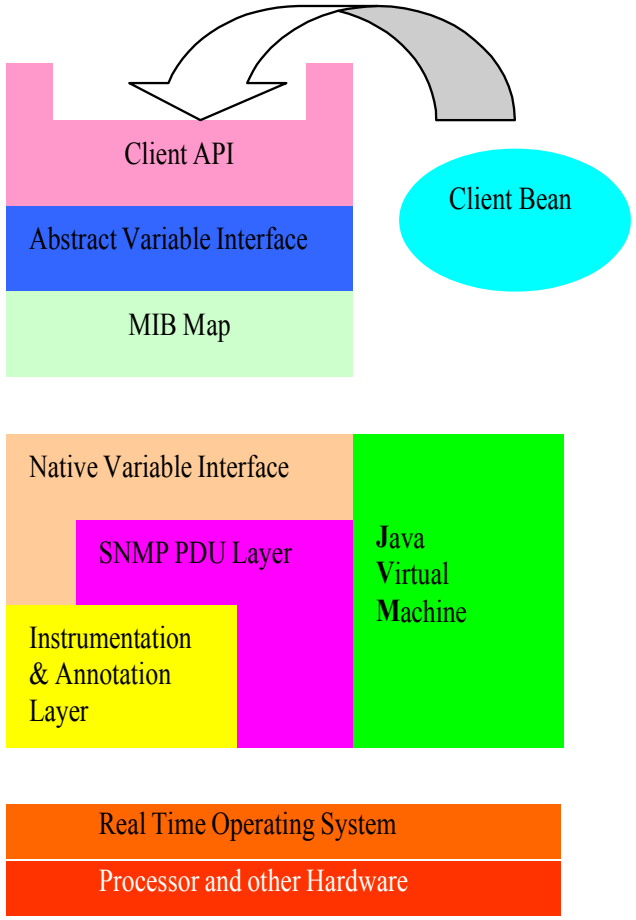
- Most of the Java code is generated automatically
- ASN.1 MIB definitions are converted into Java classes
- Documentation and commentary in the MIB definitions is placed as Javadoc formal comments
- HTML documentation generated from Javadoc

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

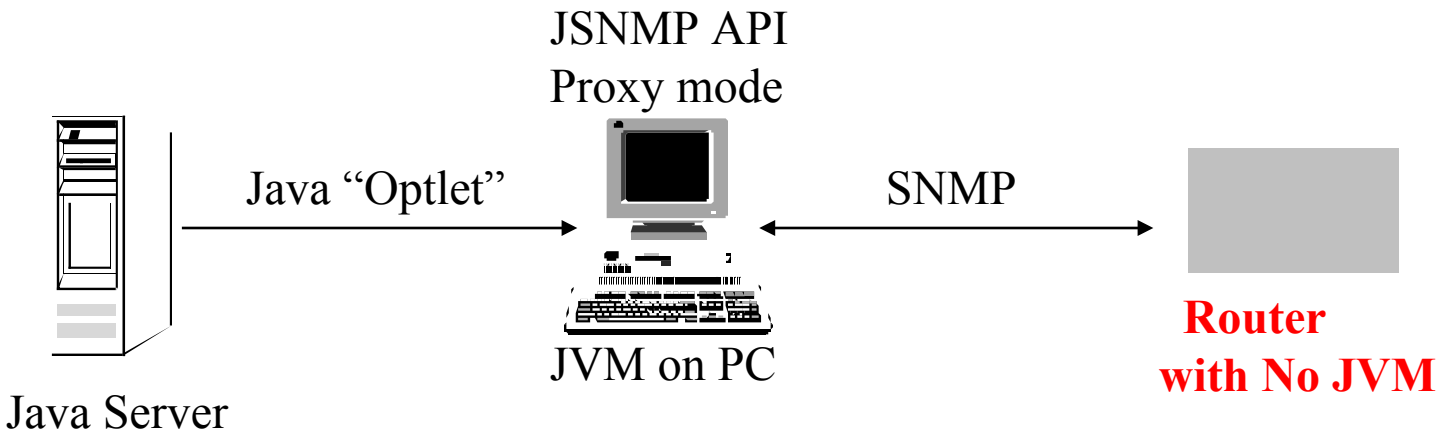


Advantages of MIB map

- 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