Modular, Cost-Effective Application Service Platform Software for Next-Generation Communication Systems

OpenClovis

Features and Benefits

- Integrated with AdvancedTCA and COTS Systems
- Enhances developer productivity
- Reduces time-to-market
- Ensures reusability of core development efforts
- Offers platform-independent modeling and implementation
- Increases development process consistency
- Minimizes software footprint for optimized performance

An Open Source Solution

OpenClovis released its code base in May, 2006 to the open source community. Guidelines are now available to open source users enabling them to test the code, make changes, and share their results with the open source community as a whole.

Already in use by leading network equipment manufacturers, including HP and IBM, OpenClovis will continue to offer its industry-leading, tested, and commercially-viable product suite. OpenClovis is designed to facilitate the creation of a broad range of telecom devices, including routers, switches, media gateways, and wireless infrastructure nodes. For further information, visit us at www.openclovis.org or www.openclovis.com

Today's telecom companies operate in a rapidly-changing marketplace. Converged multimedia networks, voice over IP, deregulation, and other factors demand a high level of marketplace agility to maintain profitability.

In turn, equipment makers are under enormous pressure to provide next-generation communication platforms that are scalable, manageable, and continuously available. Minimizing time-to-market and development costs is essential to effectively compete in this environment.

In response to these challenges, OpenClovis has created a modular, cost-effective application service platform for next-generation communications systems. This streamlined approach enables network equipment vendors to create standards-compliant, highly-available devices that feature quick integration of telecom applications onto the OpenClovis platform.

Whether you are designing a one-unit rack-mounted appliance, a multi-blade chassis-based switch, or a dense infrastructure of meshed devices, the modular OpenClovis middleware platform can give your company the competitive advantage you've been looking for. The scalable solution offers a broad array of reusable, portable software components that not only reduce development costs — they also facilitate the creation of portable designs that can be quickly customized for any standards-compliant platform.

OpenClovis provides a hardware- and operating system-agnostic environment. This enables most applications to be quickly scaled to run on multiple form factors without major changes. And the modular approach enables designers to use only the necessary components, ensuring optimal performance by minimizing the platform's software footprint.

OpenClovis is configured by OpenClovis IDE, an integrated development environment designed to accelerate the development of telecom software on the OpenClovis platform. The powerful Eclipse-based graphical user interface streamlines the process of creating system resources and components, and defining the attributes and relationships associated with them.

OpenClovis IDE enables designers to capture the information model through UML notations, and then save it as an XML file. Developers can choose to work within the familiar command line interface, or they can use the drag-and-drop user interface for a more intuitive user experience. This dual approach accelerates the learning curve, reducing development time and enhancing user accuracy.

A Standards-Compliant Solution

The OpenClovis solution is a key component in the creation of standards-based, next-generation telecom platforms. By embracing a standards-based approach, three key benefits can be realized:

- Time-to-market is greatly accelerated by leveraging standards-based architectures in both hardware and software
- Application integration is dramatically accelerated by utilizing the high-availability OpenClovis solution
- Hardware and software components can be deployed into devices manufactured by a wide range of equipment makers, breaking the costly proprietary stranglehold which has slowed industry innovation

OpenClovis provides full support for a broad range of industry standards, including:

Advanced Telecom Computing Architecture (AdvancedTCA) is a series of standards that define the parameters for both interoperability and component interchangeability of high-availability carrier-grade communications equipment

Carrier Grade Linux (CGL) defines a set of operating system requirements addressing the availability, scalability, and service response characteristics needed in next-generation carrier-grade platforms and applications

SA Forum Application Interface Specification (AIS) provides interfaces to the availability management framework, and delivers services for checkpointing, event notification, messaging, cluster membership, and distributed locking

The OpenClovis Architecture

SA Forum Hardware Platform Interface (HPI) facilitates the administration of sensors monitoring the vital signs of all hardware resources, and enables platform management software to control components via a technology-independent interface.

The need for a standards-compliant, modular, and cost-effective solution has become increasingly urgent. OpenClovis is uniquely positioned to deliver a next-generation solution that enhances developer productivity, accelerates time-to-market, and ensures the portability and reusability of critical system components.

High Availability

Ensuring high availability across the network is a key concern in mission-critical telecom environments. The OpenClovis architecture delivers a high degree of redundancy, delivering access to key services via three highly-resilient traffic handling and system recovery mechanisms.

• **Redundancy Manager** controls the active and standby availability states of components that are providing a given service, and supports automatic failover according to user-configured policies. The Redundancy Manager organizes redundant components in various configurations, such as 1:1 and N+M.

• **Checkpointing Manager** delivers redundant component synchronization of run-time data and context to ensure smooth failover if a fault occurs.

• **Group Membership** services assist applications and other OpenClovis components to define, form, manage and monitor service groups.
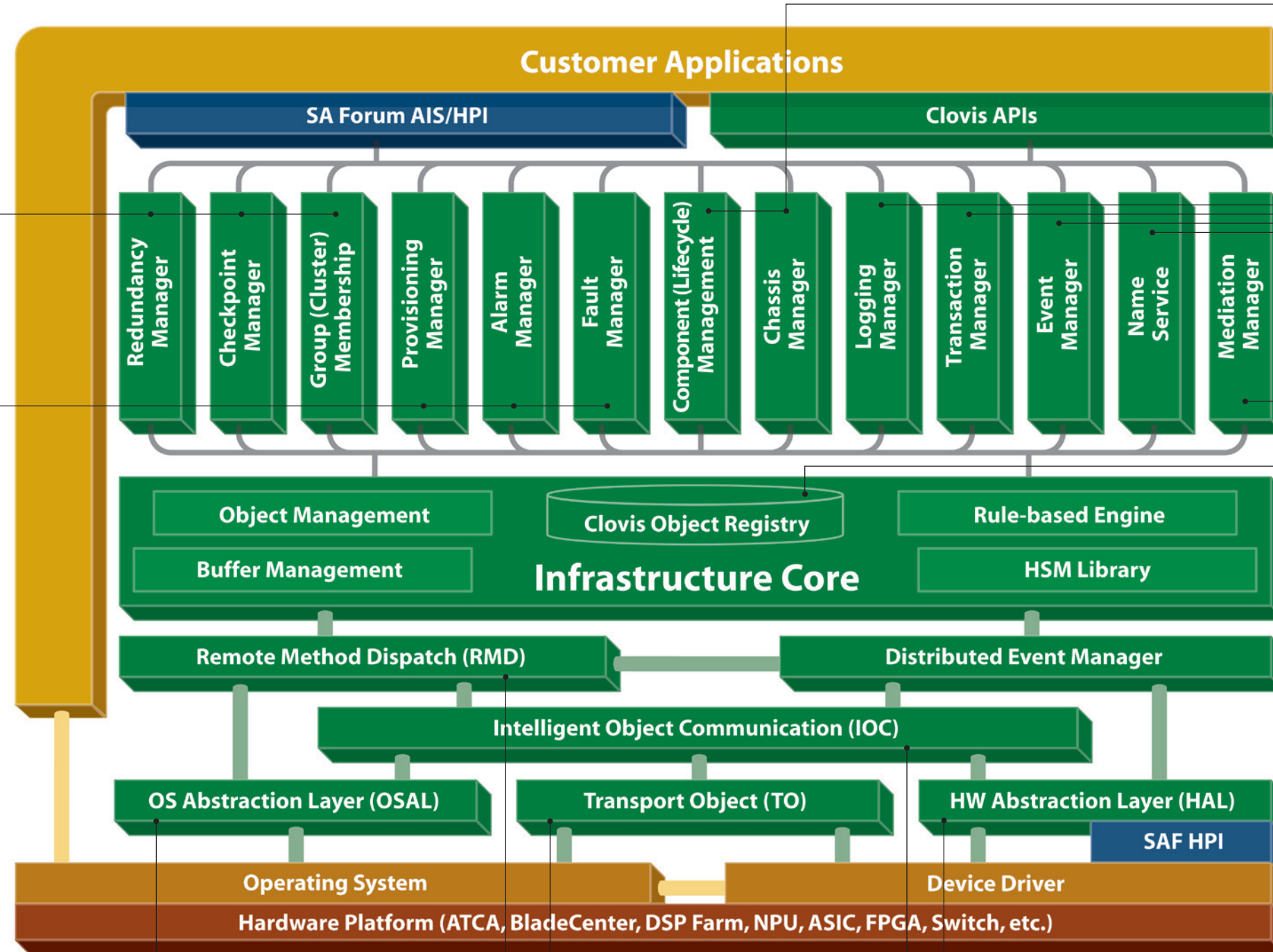
Platform and Component Manageability

Another aspect of achieving mission-critical availability is providing comprehensive platform and component manageability.

• **Provisioning Manager** is a client module that is automatically bound to every component that manages a hardware resource. Provisioning attributes are created and deleted as components start and terminate service.

• **Alarm Manager** provides an infrastructure for configuring alarms, and defining the actions to be taken when an alarm is generated.

• **Fault Manager** offers a hierarchical system for managing both hardware and software faults. Faults can be prioritized to ensure they are responded to in the order of their importance, and associated actions can be specified.

Platform and Component Manageability (continued)

• **Component Manager** monitors the health and controls the state (start, stop, resume, restart, suspend, and kill) of all active service components executing within the system

• **Chassis Manager** supervises the components of a chassis' field replaceable units (FRUs), such as blades, AMCs, and PMCs. Capable of detecting hot-swapped modules, the system is able to receive instructions from other system resources

OpenClovis Management Infrastructure

OpenClovis provides a unified infrastructure for managing the entire system.

• **Mediation Manager** provides a unified interface to the external management protocols and services (CLI, SNMP) to control the configuration and operation of all managed objects within the system.

• **Clovis Object Registry (COR)** is a distributed, object-oriented database that captures and stores data on system-managed objects and the relationships between them. COR also manages the object life-cycle, transactions on multiple objects, object change notifications, and object change propagation across all the various distributed MOs.

• **Logging Manager** is a syslog-based infrastructure that enables administrators to record significant events in the system.

• **Transaction Manager** provides an infrastructure library that uses transaction semantics to manage distributed data, enabling components that need to participate in a transaction to act as a resource manager.

• **Event Manager** provides a flexible, scalable, distributed service infrastructure for event notification across multiple blades. Maintains a copy of the local subscriber database for resilient system recovery in the event of a server failure.

• **Name Service** replicates the name database across all nodes to allow efficient, scalable lookups between applications and the local name server. Provides one-to-one mapping between the name of a service and its object reference.

Diagram labels

Customer Applications

SA Forum AIS/HPI

Clovis APIs

- Redundancy Manager
- Checkpoint Manager
- Group (Cluster) Membership
- Provisioning Manager
- Alarm Manager
- Fault Manager
- Component (Lifecycle) Management
- Chassis Manager
- Logging Manager
- Transaction Manager
- Event Manager
- Name Service
- Mediation Manager

Infrastructure Core
- Object Management
- Buffer Management
- Clovis Object Registry
- Rule-based Engine
- HSM Library

Remote Method Dispatch (RMD)

Distributed Event Manager

Intelligent Object Communication (IOC)

OS Abstraction Layer (OSAL)

Transport Object (TO)

HW Abstraction Layer (HAL)

SAF HPI

Operating System

Device Driver

Hardware Platform (ATCA, BladeCenter, DSP Farm, NPU, ASIC, FPGA, Switch, etc.)

• **OS Abstraction Layer (OSAL)** provides an OS-independent software layer that enables common, uniform APIs and custom applications to access OS services required by the OpenClovis runtime environment.

• **Transport Object (TO)** provides a standardized interface to underlying communication links and protocol stacks. It can operate over UDP/IP and any underlying IP-capable link, or it can be mapped directly to the link layer such as Ethernet, ATM, or RapidIO.

• **Hardware Abstraction Layer (HAL)** provides OpenClovis and applications with a hardware-agnostic interface to processors located on the peripheral hardware.

• **Remote Method Dispatch (RMD)** transparently invokes methods exported by various software components, regardless of whether the object resides locally or is located on a remote blade.

• **Intelligent Object Communication (IOC)** provides messaging services between objects distributed across various blades, and allows location transparent addressing.

OpenClovis IDE — an innovative, model-driven approach for system architecture and design.

OpenClovis IDE is an integrated development environment designed to simplify and accelerate the development of application service platforms for the telecom marketplace. Coupled with the OpenClovis platform, the intuitive software solution streamlines the process of specifying the information model, high availability (HA) aspects, and the communication infrastructure of a system.

This advanced application stores all information describing a project in well-defined XML files that can be modified by the user, and generates customized code ready to run on the OpenClovis platform. OpenClovis IDE provides the ability to generate and compile code, and deploy the resulting image onto the target system under development.

The Eclipse-based graphical user interface streamlines the process of system modeling, information modeling, and product development on the OpenClovis platform. Modeling of system resources and their relationships such as containment, aggregation, and inheritance are specified using a graphical UML editor. Modelled artifacts are reusable across multiple projects, shortening development time and increasing design team efficiency.

OpenClovis IDE provides two views: the physical (resource) view, and the logical (component) view. These two views are linked, delivering a high level of visibility into the system under development.

The physical (resource) view clearly displays the chassis, blades, daughtercards, network ports, other devices, and the software entities running on the displayed hardware. The physical containment hierarchy is used to define the Managed Object (MO) tree, and to derive the MO path (addressing) information.

The logical (component) view displays service availability of the system, using concepts such as cluster, nodes, service units, service groups, service instances, proxy components, non-proxy components, and proxied components.

OpenClovis IDE facilitates collaborative work by clearly separating out generated code that is user-modifiable. The advanced design framework anticipates the incremental development of a system under design, enabling user changes to be read back into the IDE and modified on an as-needed basis.
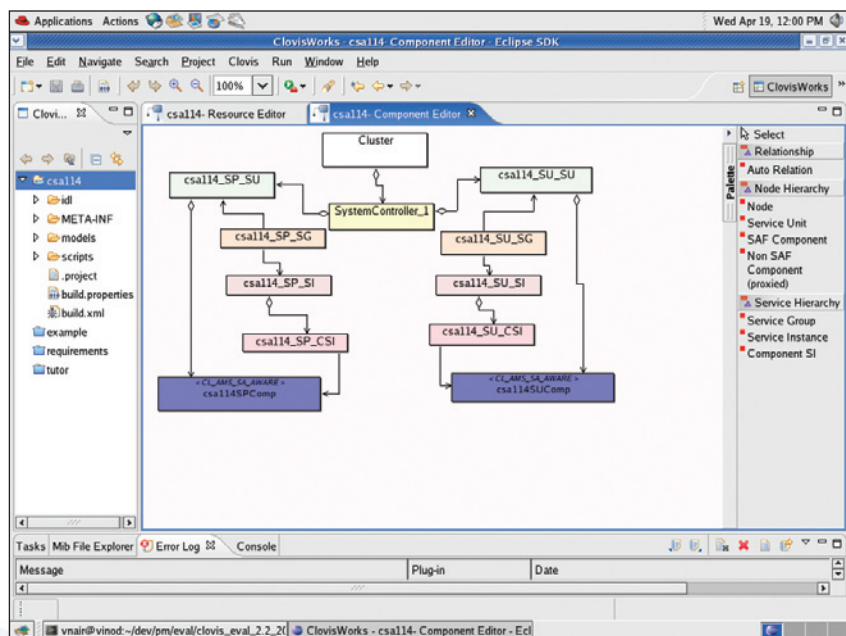
OpenClovis IDE, an Eclipse-based development environment (Component Editor View shown).

About OpenClovis: OpenClovis is the leading provider of application service platform software to the telecommunications industry. Founded in 2002, OpenClovis is leveraging more than 450 years of collective communications systems expertise to revolutionize the development and deployment model for next-generation communication systems. OpenClovis delivers a modular, end-to-end software solution for creating application service platforms. This innovative approach enables solutions integrators, network equipment providers (NEPs), and telecom equipment manufacturers (TEMs) to bring new products to market more quickly, with smaller investments in R&D. By using the innovative OpenClovis software infrastructure design platform, customers can gain a competitive advantage in today's fast-moving and converging market environment. OpenClovis is headquartered in Petaluma, California, in the heart of Telecom Valley, and also has a significant R&D facility in Bangalore, India.

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