The SCOPE Alliance imposes profiles on standards

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The main objective of the SCOPE Alliance is to help to develop a powerful ecosystem that enables the network equipment providers to build carrier grade telecommunication systems from components supplied by different vendors that fulfill the needs of their customers.

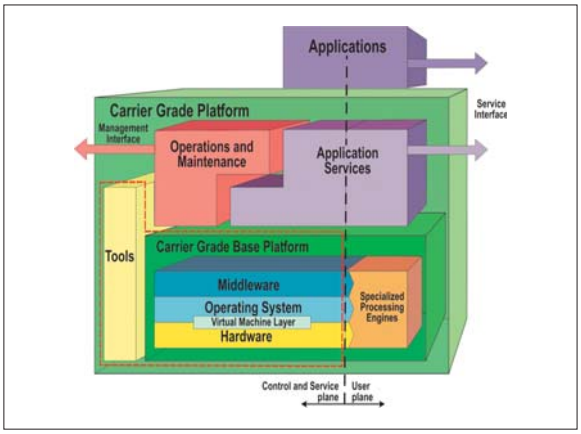

Figure 1. The SCOPE reference architecture for carrier grade platforms

In the telecommunication industry, the network equipment providers develop and use carrier grade platforms within their network elements that must provide high availability, reliability, serviceability, scalability and performance. Increasingly, carrier grade platforms are implemented as commercial off-the-shelf (COTS) hardware and software components and free open source software (FOSS) components that are based on industry standards and/or open specifications.

The SCOPE Alliance is an association of network equipment providers that aim to enable and encourage an ecosystem of suppliers of such hardware and software components in order to promote high-quality telecommunication platforms, reduce development time and costs, and satisfy the needs of their customers. When different suppliers provide different components of a telecommunication platform, those components must be compatible and must interoperate. Furthermore, the components must be interchangeable so that the network equipment provider is not beholden to any one supplier or group of suppliers.

To promote interoperability and interchangeability of such components, various standards organizations have developed specifications for those components. Those standards bodies, and the areas they address, include: PCI Industrial Computer Manufacturers Group (PICMG) for physical hardware; Service Availability Forum (SA Forum) for high availability middleware interfaces and Open Software Development Laboratory (OSDL) for carrier grade Linux. However, those standards are often appropriate and useful for applications other than telecommunications, and they have grown to encompass many specifications, requirements and features that are not appropriate or necessary for carrier grade platforms. As a result, the potential suppliers of the carrier grade platform components do not know where to focus their efforts.

The SCOPE Alliance is an association of network equipment providers that review industry standards and open specifications to determine their relevance and applicability to telecommunication systems. The objective of SCOPE is to identify subsets of existing standards and specifications (called profiles) that are relevant to the carrier grade base platforms of the telecommunication industry, as well as to identify gaps in those standards and specifications. The SCOPE Alliance is organized as a program of the IEEE Industry Standards and Technology Organization (IEEE-ISTO). The sponsor members of SCOPE are major network equipment providers, namely: Alcatel-Lucent; Ericsson; Huawei Technologies; Motorola; NEC Europe; Nokia and Siemens Networks.

In addition, the SCOPE Alliance currently has 12 contributor members, which are component suppliers. The member companies of the SCOPE Alliance contribute experts that review the standards and generate a profile for each of the standards and identify gaps in the standards. SCOPE does not itself define standards, and it does not provide specifications to fill the gaps that it has found in existing standards.

The SCOPE reference architecture, shown in figure 1, is divided into the following main areas: 1) operations and maintenance, which enable the user to operate and control the underlying platform and its applications; 2) tools which facilitate the design of complex systems,

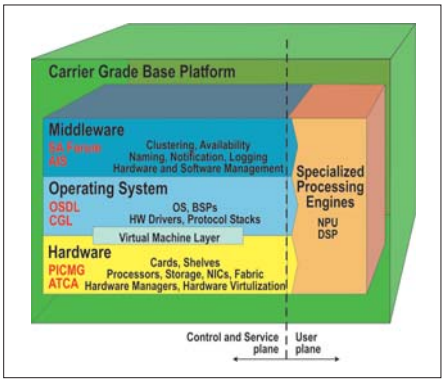

Figure 2. The carrier grade base platform of the SCOPE reference architecture

specification of configuration files, interactions between the user and tools, etc. 3) application services which include database management systems, storage management systems, application execution environments, etc. 4) carrier grade base platform which is the core of the SCOPE reference architecture.

The SCOPE Alliance is focused on the control and service plane, to the left of the black dashed line in figure 1, which is vital for interoperability between components, rather than on the user plane, where differentiation exists. The initial focus of SCOPE is on the carrier grade base platform and tools, shown within the red dashed line in figure 1. The carrier grade base platform, shown in more detail in figure 2, includes: hardware, such as blades, shelves and cabinets; operating systems, particularly carrier grade Linux as well as middleware, particularly high availability middleware. The carrier grade base platform also includes specialized processing engines, such as digital signal processors, network processing units, fabric routing engines, etc.

Standards and open specifications for various aspects of the carrier grade base platform already exist, three of which are shown in red in figure 2. The SCOPE Alliance seeks to select subsets of existing standards (called standards profiles) that are relevant to telecommunication systems. SCOPE also aims to identify gaps in those standards as they apply to telecommunication systems. Few industry standards for tools for the development, testing and deployment of telecommunication systems currently exist, even though such tools standards could reduce the difficulties of combining together components from different vendors into a carrier grade system. SCOPE is encouraging the development of tools standards, and plans to describe requirements (called content profiles) related to functions and properties of the tools. The tools standards in which SCOPE is interested include: 1) UML model-driven architecture of the object management group for design of complex systems; 2) XML formats specified by the world wide web consortium for specification of configuration files; 3) Eclipse guidelines for interactions between tools and their users. 4) Unix tools for system development. The SCOPE Alliance has already issued profiles for the PICMG Advanced telecommunication computing architecture (ATCA) standard and for the OSDL carrier grade Linux (CGL) standard. High-level descriptions of those profiles are included below. The descriptions below are necessarily abbreviated and must not be regarded as definitive. For a complete and authoritative definition of the SCOPE Profiles, see the SCOPE web site (http://www.scope-alliance.org).

The SCOPE profile defines the aspects of a particular standard that are required for telecommunication systems, and the aspects that are optional. SCOPE distinguishes between two kinds of profiles: 1) standards profile, which is a subset of an existing specification that is appropriate for carrier grade systems; 2) content profile, which is a description of requirements related to functions and properties related to a particular aspect of carrier grade systems. A SCOPE profile can also identify gaps in the particular standard. The SCOPE Alliance has developed a first version of the profile for the PICMG 3.0 hardware standard, which is also known as the AdvancedTCA or ATCA standard for telecommunication systems. The SCOPE profile for ATCA addresses eight PICMG specifications, including the ATCA base specification, Ethernet/Fiber Channel, Advanced Mezzanine Card (AMC), PCI Express and Advanced Switching, Gigabit and 10 Gigabit Ethernet, AMC Storage, Intelligent Platform Management Interface (IPMI) and Intelligent

Category	Feature Description	Comment
AMC interconnection	1 GE dual star (PICMG AMC.2,Type E2).	Mentioned here due to impact of the board design of ATCA blades.
AMC fabric interface	Fabric interconnection is GE or PCI-Express (minimum 4 times).	Mentioned here due to impact of the board design of ATCA blades.
Blade thermal requirement	Minimal air flow over pressure drop curve requirement per blade to be specified by the suppliers. Hydraulic impedance must be specified by the board suppliers. The board thermal design must be able to support 4 AMCs with a budget of 200 W per slot: power dissipation, hydraulic impedances.	Hydraulic impedance must be defined for interoperability in PICMG ATCA (gap of ATCA).
Shelf Manager	Redundant shelf manager either integrated or separate from the switch. Shelf manager is considered to be an integral part of the shelf for low-level hardware management.	
Shelf Manager	Modular modifiable software. Shelf manager itself has no standard. HPI is the only way to get standardized access to it.	Remote loadable software aspects must be defined for interoperability in the SA Forum HPI (gap of HPI).

Table 1. Some of the requirements of the SCOPE ATCA profile

ID	Description	OSDL Priority	SCOPE Priority	Comments
AVL 12.0	NFS Client Protection Across Server Failures	Future	Mandatory	
CAF 1.0	Cluster Availability Framework (SA Forum AIS)	Necessary	Not Required	Needed functionality should be provided in middleware not OS.
PLT 1.3	CPU Blade Hot Swap Event Message	Necessary	Mandatory	
PRF 1.5	POSIX Real-Time Features	Necessary	Mandatory	
SEC 4.1	IPsec for IPv4 and IPv6	Necessary	Mandatory	
SFA 11.0	User Space Debug Support for Threads	Future	Not Required	Needed support will be addressed in Tools profile.
STD 10.1	802.1Q	Necessary	Mandatory	This requirement should be split into two. VLAN endpoint functionality is important, bridging functionality is not.

Table 2. A few of the requirements of the SCOPE Linux profile

Platform Management Bus (IPMB). For interconnections and cabling, some of the requirements of the ATCA profile are GE dual star AMC interconnections and GE or PCI Express AMC fabric interfaces, Ethernet fabric interfaces 1/2/4 with aggregation or 10Gbit/s per slot, redundant radial or bussed IPMB, mandatory front cable access and rear access when a rear transition module is used.

For shelves and power, the ATCA profile requires 14 or 16 slots per shelf, maximum 200 W power dissipation per blade, shelf must be able to power a full population of blades consuming 200 W, redundant power feed of 48 VDC with -60 VDC option, and extensive requirements on air flow, cooling and noise. For management and serviceability, the ATCA profile requires a redundant shelf manager with modular software, redundant IPMB and update interface, hot swap of blades and in-service replacement of fans and filters. The ATCA profile also requires compliance with certain regulatory directives. Five of the 25 requirements of the SCOPE ATCA Profile are shown in table 1.

The SCOPE Alliance has also developed profiles (v1.0 & v1.1) for the OSDL carrier grade Linux (CGL) 3.2 operating system specification. SCOPE has prioritized the requirements of that specification based on the needs of the telecommunication market for service and control applications. In developing the Linux profile, SCOPE considered support for an open blade environment such as that defined by PICMG (ATCA). The SCOPE profile for Linux characterizes the requirements of the CGL 3.2 specification as mandatory, desirable, already available, not needed and did not prioritize. Of the 247 requirements of CGL 3.2, 108 are determined to be mandatory, 24 desirable, 78 not needed, 27 already available, and 10 not prioritized. Moreover, several of the requirements are determined to be incomplete, imprecise, or subject to multiple interpretations.

The SCOPE Linux profile addresses the seven areas addressed by CGL 3.2, namely, availability, clustering, hardware, performance, security, serviceability and standards, as outlined below. Availability refers to such aspects of carrier grade Linux as robust mutexes, NFS client protection across server failures, parallel user initialization during startup, iSCSI error handling support, Ethernet link bonding and watchdog timers. Clustering encompasses the cluster availability framework, communication service, software upgrades, checkpoint service, diagnostics, event service, failure handling, lock service, monitoring, membership service, storage systems and file systems. Hardware addresses configuration support, hot swap, shelf management, iSCSI, IPMI, diskless systems and remote boot.

Performance encompasses low latency scheduling, round robin scheduling, POSIX real-time features, hyper-threading support, and various requirements related to timers, threads, mutexes, priorities and interrupts. Security includes various security mechanisms such as a dynamic kernel security module, process containment, buffer overflow protection, access control, authentication, password integrity checking, log analyses, IPsec for IPv4 and IPv6, PKI and SSL/TLS support for applications, memory limits, and file system, process and execution quotas. Serviceability includes such topics as panic, dump, debug, snapshots and profiling at the kernel level and in user space, diagnostics related to temperature, fans, power media, networks, CPUs and memory monitoring, and software upgrade and rollback.

The standards area covers Linux standard base compliance and POSIX compliance, as well as support for CIM, WEBM, ACPI, PCI Express, iSCSI, MPI, NPF, SCTP, IPv6, IPSec, SNMP, IPMI and the various SA Forum specifications. For each of these seven areas, an example prioritized requirement for the SCOPE Linux Profile is shown in table 2. The SCOPE Alliance is currently developing a profile for the Appli-

cation Interface Specification (AIS) high availability middleware interface specification from the SA Forum. The AIS includes an availability management framework and a number of services, namely the cluster membership, notification, information management model, event, log, checkpoint, message and lock services. It also defines several redundancy models, including no redundancy, N+M, 2N, N-way and N-way active, as well as other features and options related to high availability. SCOPE is currently considering which of these aspects of the AIS are most appropriate and useful for carrier grade systems, and thus for inclusion in the SCOPE AIS profile.

SCOPE is also working on content profiles for tools that are used to develop, test and deploy carrier grade telecommunication systems. SCOPE expects to describe requirements related to functions and properties of such tools. They are scoping various standards for tools such as the UML-based model-driven architecture for designing complex systems, XML for specifying configuration files, the Eclipse guidelines for interactions between tools and their users, and various Unix system development tools. Such content profiles for tools can reduce the difficulties of integrating software components from different suppliers into carrier grade systems.

The SCOPE Alliance has already developed profiles for the PICMG 3.0 advanced telecommunication computing architecture 3.0 specification and for the OSDL carrier grade Linux 3.2 specification. SCOPE is currently developing a profile for the SA Forum application interface specification, as well as profiles for tools that enable the development, testing and deployment of carrier grade systems. The SCOPE Alliance encourages contributions to, and comments on, the profiles that it develops, and encourages companies to build and supply components for carrier grade telecommunication systems based on the SCOPE profiles and the corresponding standards. ■