

Linux Calling Seminars

Convergence on and with Linux: Key Trends in Open Source Communications

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May 4 – Stockholm, Sweden

May 5 – Helsinki Finland

Hosted by

WIND RIVER

Presentation Abstract

Convergence on and with Linux Key Trends in Open Source Communications

This presentation will highlight the large and still growing impact of Linux in telecommunications and networking applications. It will document ascent of Linux from *ad hoc* infrastructure use to its present mission-critical deployment in core and edge applications. It will also examine the strong emerging deployment of Linux in client devices for service delivery (mobile and VoIP phones and digital video) towards its eventual presence as an end-to-end OS. The speaker will draw on use cases from OSDL Carrier Grade Linux and Mobile Linux initiatives and the ecosystems around them.

Agenda

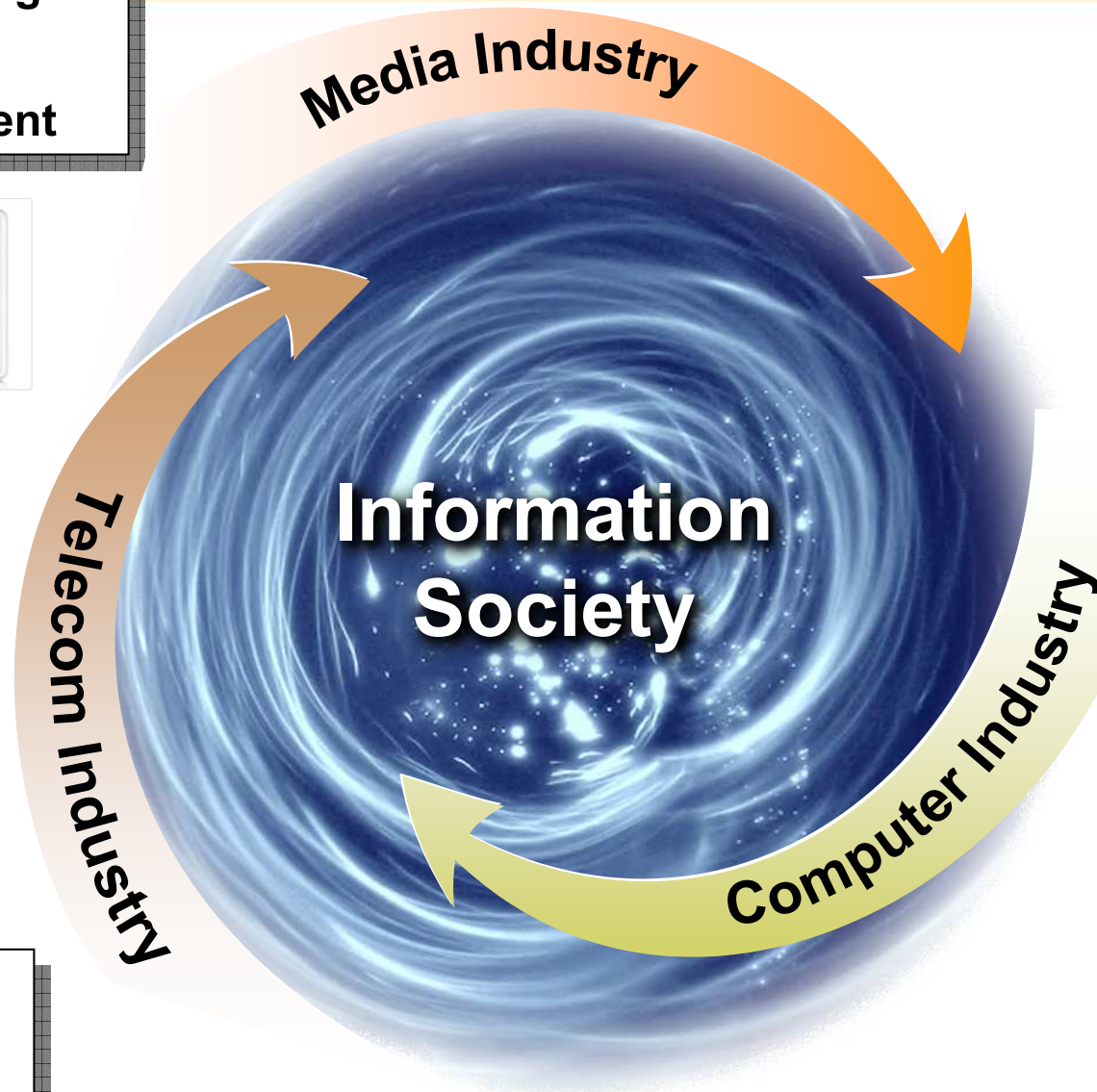
- Linux in Communications
- Carrier Grade Definition, Applications, and Markets
- Technology Focus Areas and Requirements
- Carrier Grade Linux – Working Group and Process
- Industry Adoption
- Conclusion

Convergence

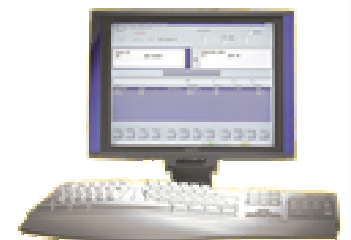
- Browsing
- Broadcasting
- Publishing
- Entertainment



- Fixed
- Mobility
- Positioning



- Desktop
- PC
- PC-LAN
- Broadband

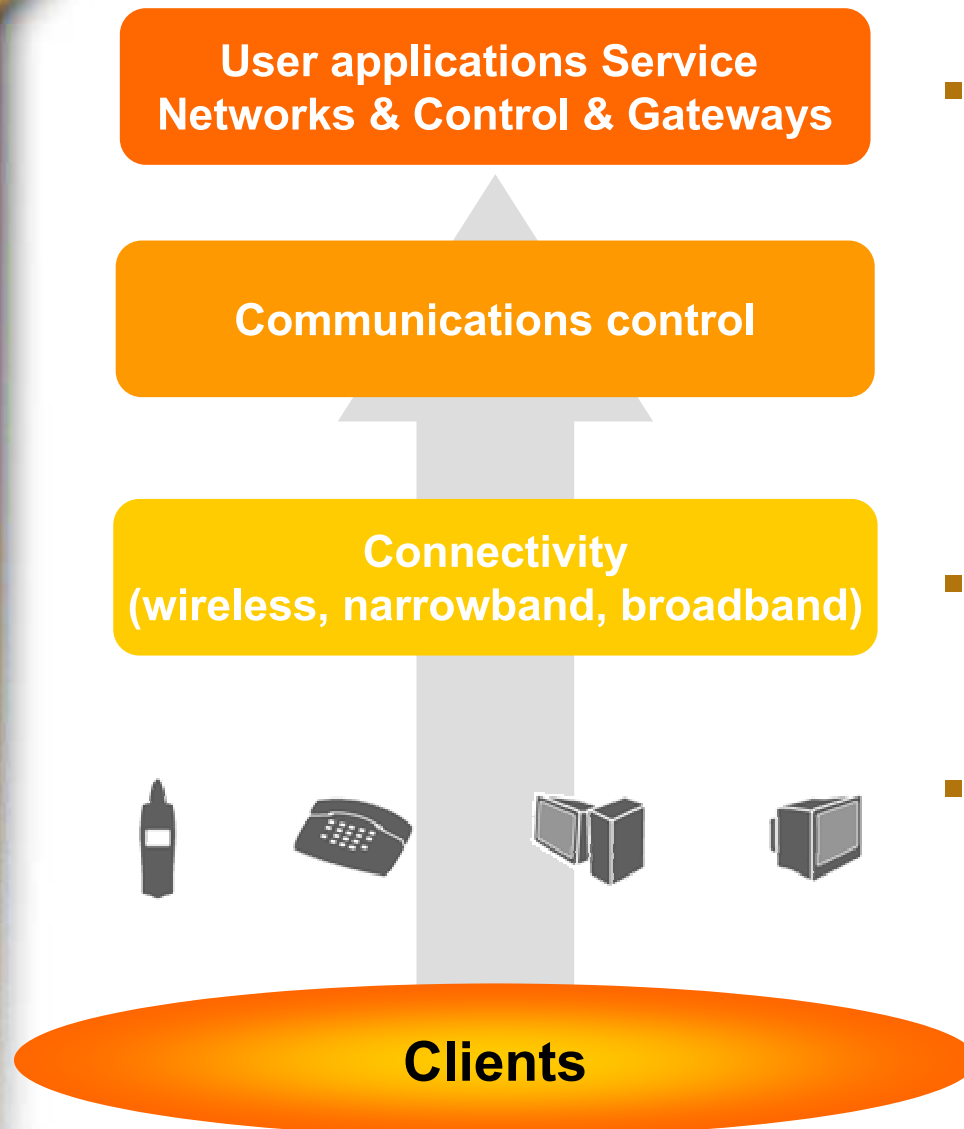


Current-Generation Network Architecture



- Parallel, single purpose networks
 - Complicates bundled services
 - Makes management is difficult, expensive
 - Fragmented billing
- Multiple, Single purpose OSeS / Platforms
- Divergent communication protocols

Next Generation Network Architecture

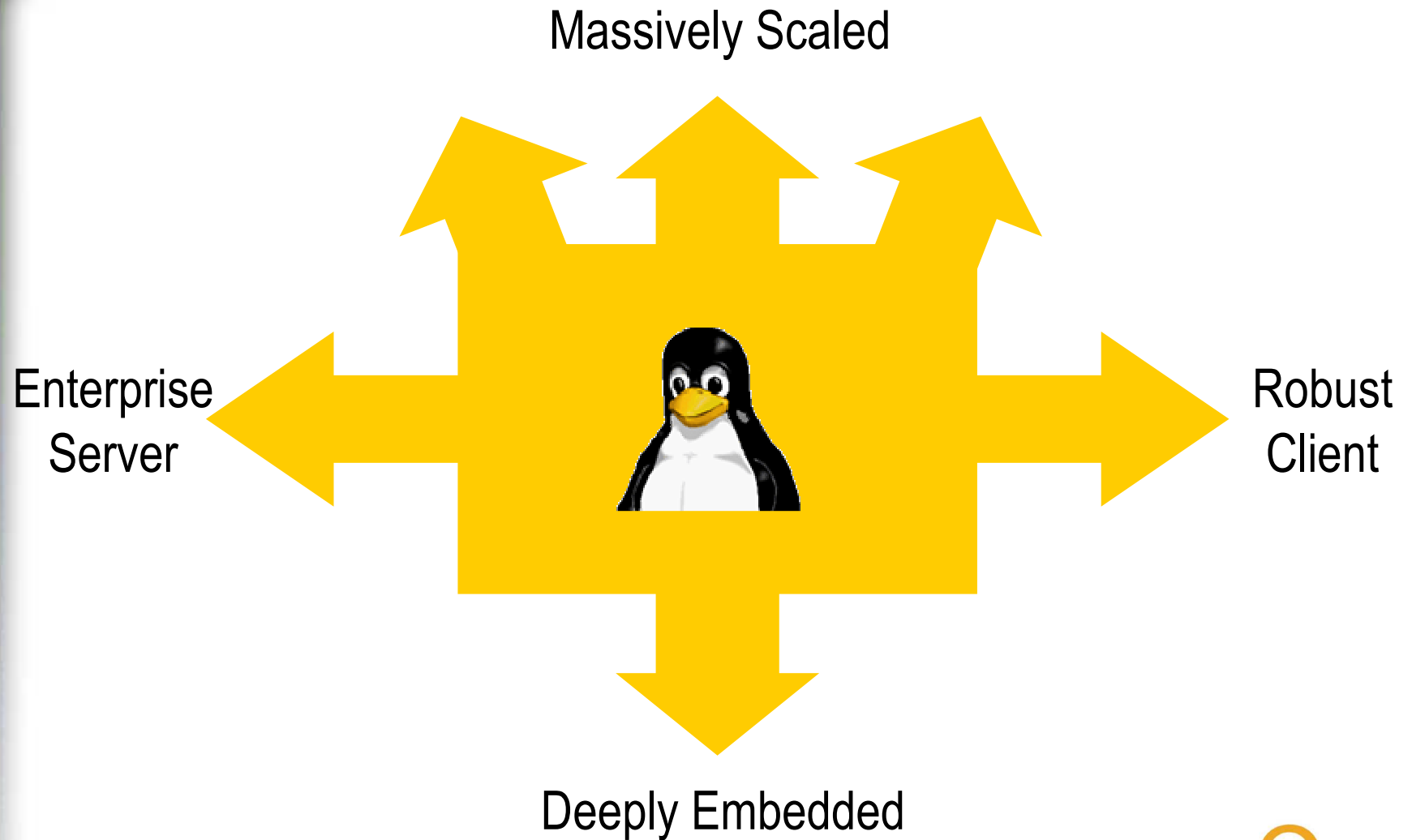


- Unified backbone
 - Bundled services
 - Easy service creation
 - Network management
 - Consolidate billing
- Linux at all layers as OS of preference
- IP as common protocol

In parallel, another convergence is happening!

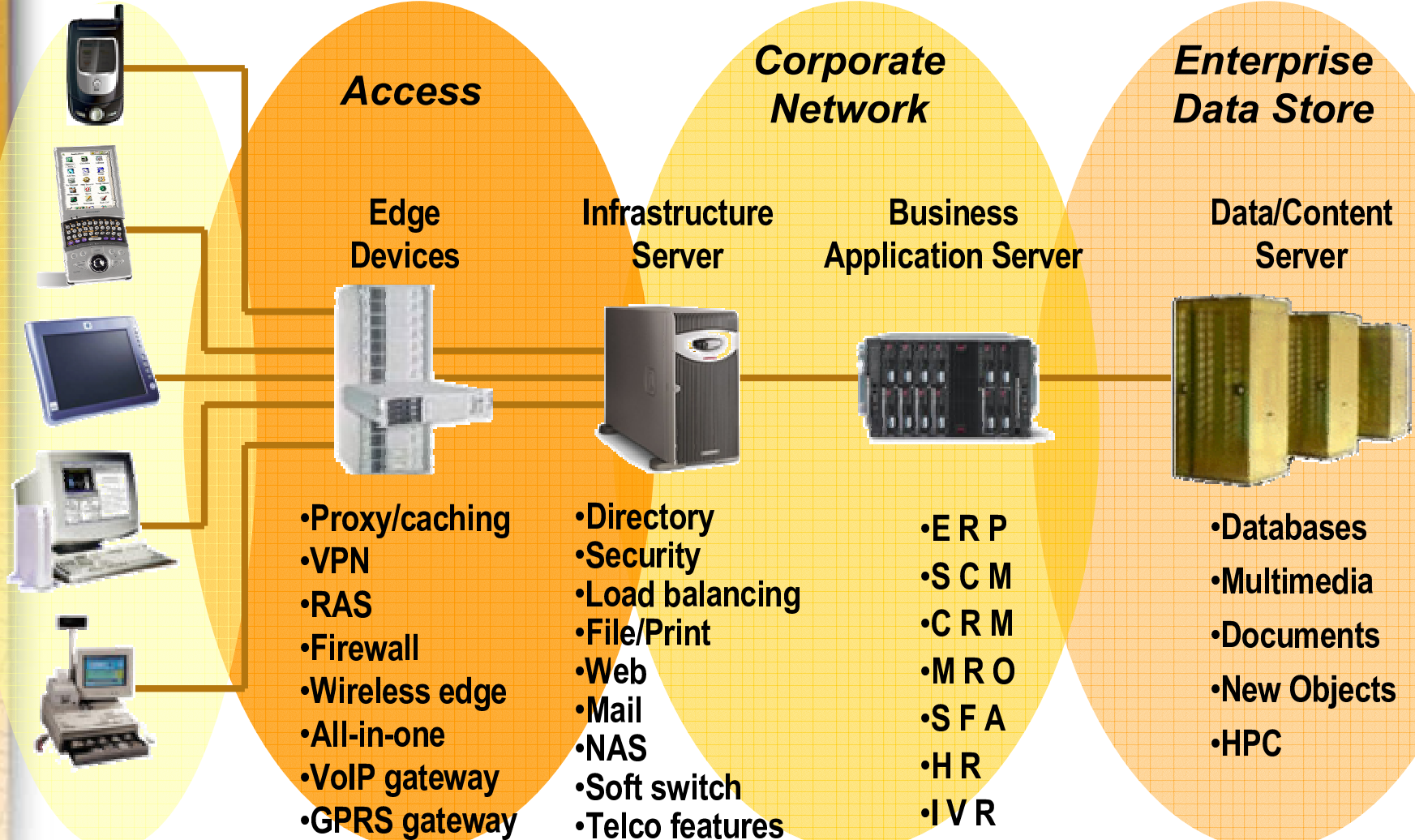
- Linux end-to-end
 - Linux on mobile devices
 - Linux on Carrier Grade routers
 - Linux on Carrier Grade Servers
- IP end-to-end: IP is the dominant protocol
 - Faster provisioning of new features
 - Easy integration of network elements
 - Simplify harmonization of standards
 - Stimulate creation of new services

Linux provides a unique scalable platform

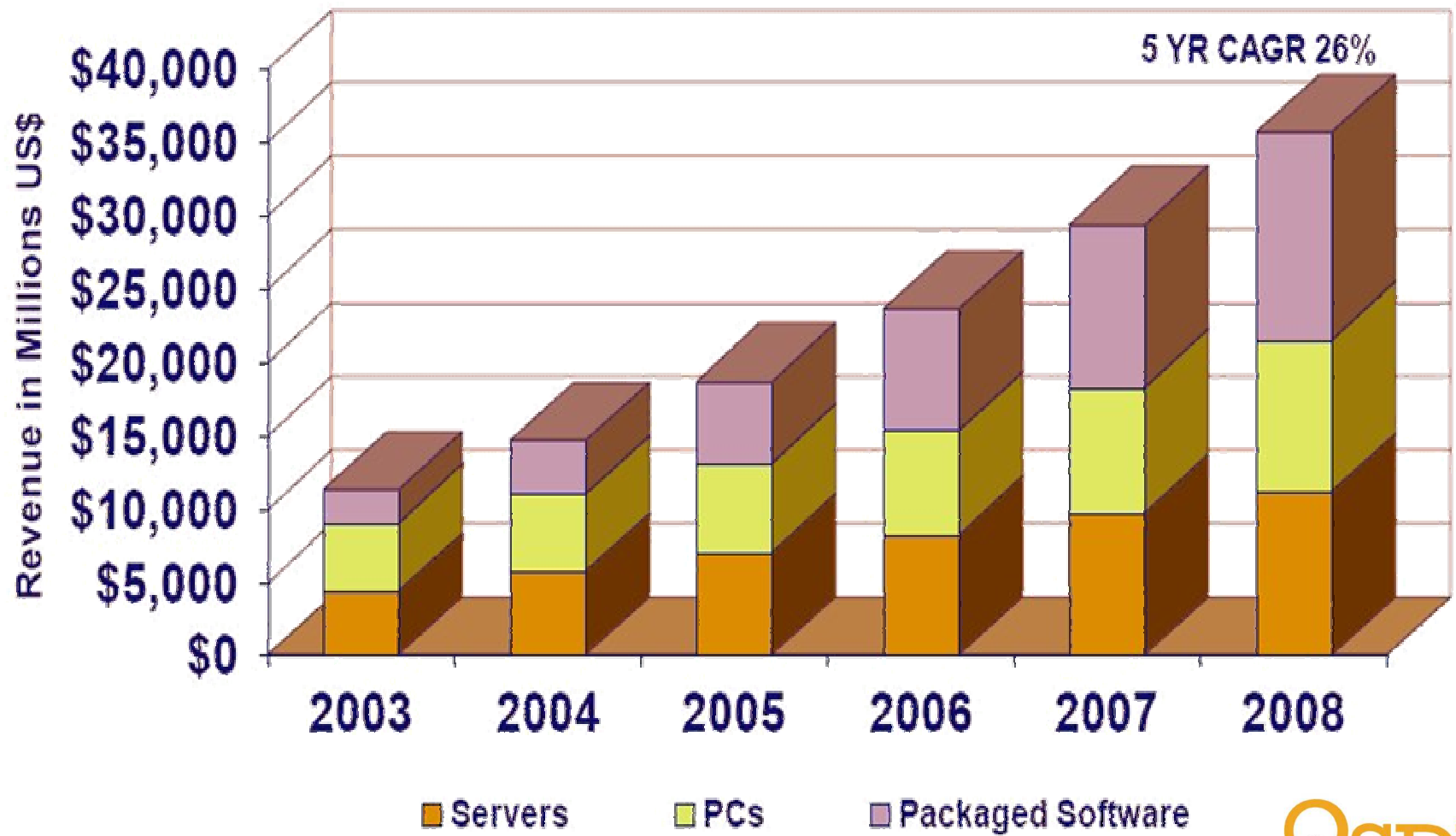


Emerging Linux – Out from Utility Computing

Client Devices



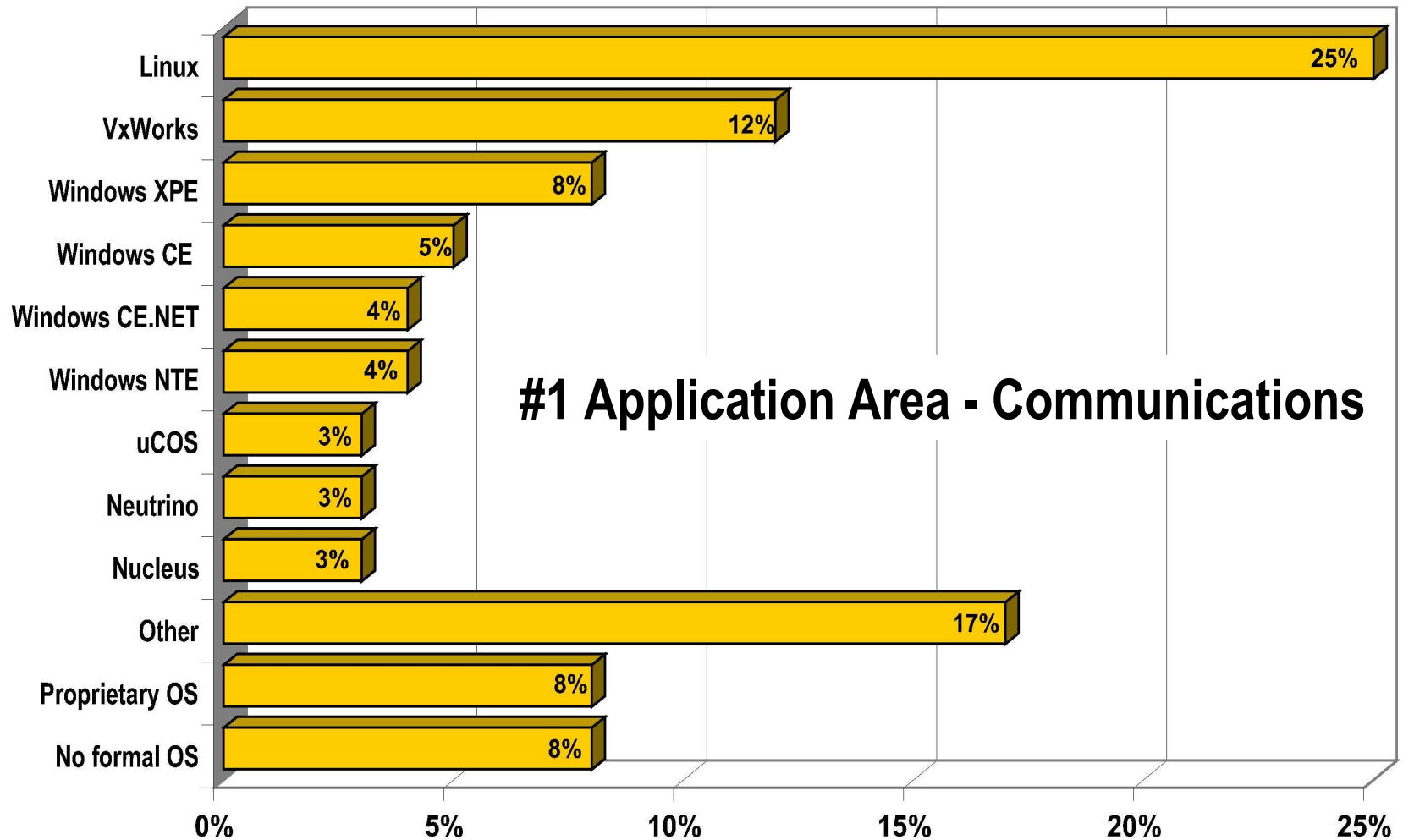
Strong Linux Adoption in Enterprise



Embedded Linux Application Space

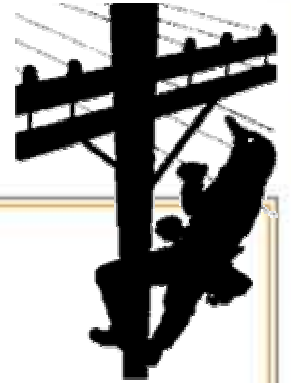
- Communications Infrastructure
 - Switches, routers, base stations, access points, hot spots, media gateways, SLAM, firewalls . . .
 - Wireless and wire-line
- Consumer Electronics
 - Handheld devices – cell phones, PDAs, media players, cameras
 - Automotive – in-car entertainment, navigation, satellite radio
 - Home entertainment – TV, HDTV, DVR/PVR, home gateways, home control
- Instrumentation and Control
 - Medical devices, industrial monitoring, manufacturing control, test equipment
- Aerospace and Defense
 - Secure networking, command and control, launch systems, simulation
- Office and Retail Automation
 - Printers, faxes., scanners, MFDs, voice mail, voice conferencing, POS, transaction terminals, thin clients
- Almost every other type of embedded design!

Linux in Embedded – Reality Check



VDC: OS Choice for 32/64 bit applications in 2005

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Carrier Grade Linux - Definition

- Linux Enhanced to meet TEM/NEP/Carrier Requirements
 - Availability
 - Reliability
 - Scalability
 - Performance
 - Security
 - Serviceability
- Differentiators from “Standard” Data Center Linux
 - Application Pre-load
 - Hot-swap / Hot Plug
 - IPv6
 - SAF-AIS interfaces for clustering
 - SAF-HPI for platform management
 - “Hardened” Kernel and Drivers
 - Soft Real-time
 - IPMI
 - SCTP

Carrier Grade Linux – Voice and Data Applications

- Architectural Roles
 - Management Plane
 - Control Plane and Slow-path/Out-of-Band Data Plane

- TEMs, NEPs and Carrier Applications: Core and Edge
 - 2.5G and 3G Wireless Mobile Markets
 - BSC, RNC, HLR/VLR
 - Switch Control Plane and Management Controllers
 - Gateways and Softswitch

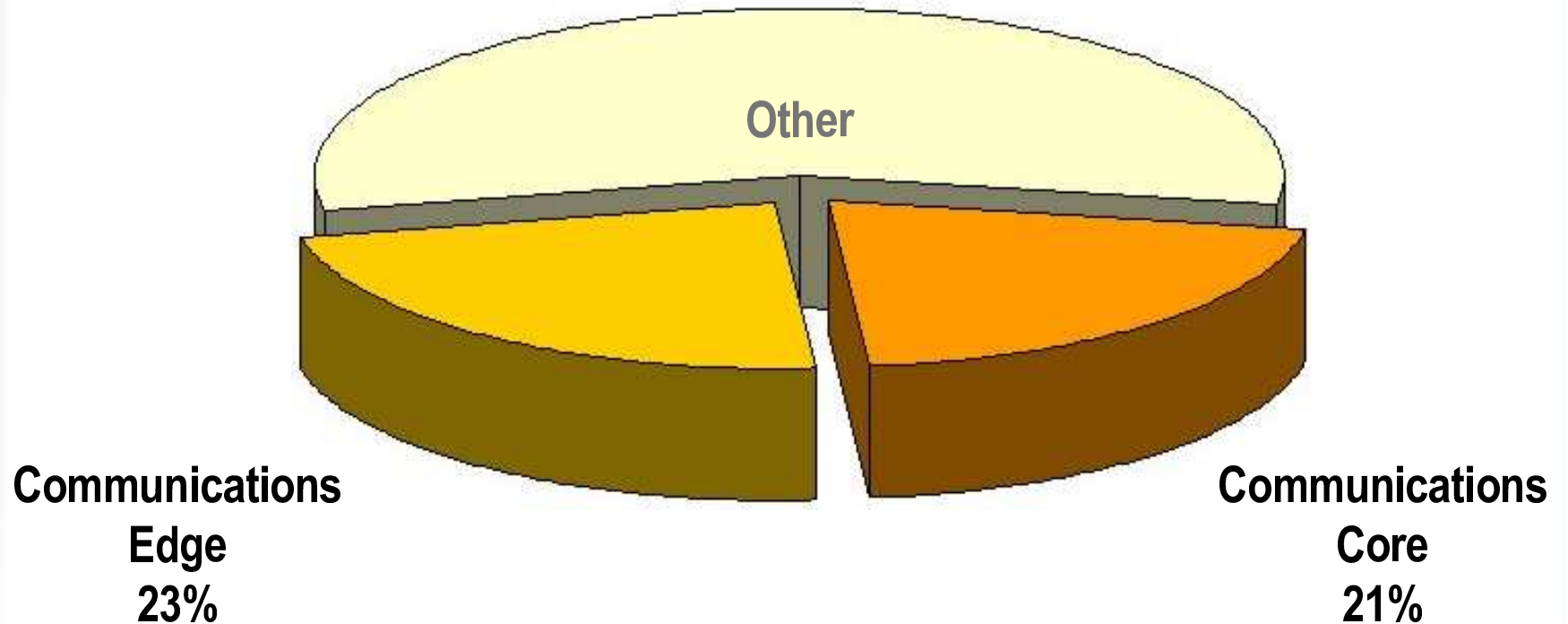
Carrier Grade Linux – Global Market Opportunity

- Global Convergence Trends
 - Voice & Data networking systems melding into single IP-based infrastructure
 - VoIP, Messaging, Streaming Multi-media Applications
 - Conversion of legacy circuit-switched phone networks to IP
 - Multi-year, multi-billion \$\$ build-out underway
- Top Global TEMs and NEPs
 - Migrating from proprietary UNIX and RTOSes to Linux
 - Need to meet ever-more-stringent carrier requirements
 - Time-to-market pressures demand COTS s/w & h/w solution

Carrier Grade Market Opportunity - Hardware

Single-Board Computer Market 2005 – US\$1.5 Billion

ATCA, CPCI, VME, PCI, etc. – Total 2M units



CGL Market Opportunity – AdvancedTCA

AdvancedTCA™

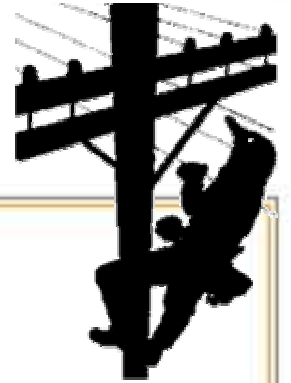
- AdvancedTCA
 - Projected to grow to US\$3.7 billion by 2007
 - 50,000 units by 2005 growing to 1.6 million by 2007
- Telecom segments served include
 - Wireless access/edge, wireline access, edge, core and signaling
- Next-generation COTS Platform
 - Successor to CompactPCI
 - Dominated by IA-32, IA-64 and PXA architectures

Sources: Intel Corporation and Global Fluency

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CGL Requirements Areas

- Standards-compliance / APIs
- Hardware Support
- Availability
- Clustering
- Security
- Performance
- Serviceability

Standards-compliance and APIs



- For broad industry support, CGL Working Groups work with other standards bodies
- Stipulates compliance to published standards
 - Linux Standard Base (LSB)
 - POSIX
 - IPv6
 - Service Availability Forum (SAF)
 - PICMG (PCI Industrial Computer Manufacturers Group)



CGL Requirements Areas

Hardware Support



- CGL includes requirements to support interoperability with carrier hardware platforms
 - Not specific to particular h/w platforms
 - Can be implemented on various CPUs, buses, etc.
- Vendor- and Implementation-Independent Platform capabilities can include:
 - Hot Swap (Hot Insert/Hot Replace/etc.)
 - Remote boot and boot cycle detection
 - Diskless application load / execution over a network
 - Advanced Telecom Computing Architecture (ATCA) support



CGL Requirements Areas

Availability



- Three Focus Areas
 - Software Reliability
 - Hardened OS and drivers, more robust S/W components
 - Elimination of single-points of failure in H/W
 - RAID, reliable file systems, Ethernet aggregation, redundant power supplies and cooling, warm/cold spares
 - Elimination of single-points of failure in S/W
 - Application Heartbeat, Clustering, Interface Failover

"Nines"	Application	Up Time %	Actual Down Time
2	Office Equipment	99.0%	3 days 15.6 hours
3	Most IT Infrastructure	99.9%	8.76 hours
4	Internet Infrastructure	99.99%	52.56 mins
5	PSTN & Other Business Critical Apps	99.999%	5.26 mins

CGL Requirements Areas

Serviceability



- Requirements target servicing and managing hardware and software on carrier systems.
- Wide-ranging requirements enhance availability of applications and the OS:
 - Producing and storing kernel dumps
 - Dynamic debug of the kernel and running applications
 - Remote access to event logs
- Carriers require tools to facilitate diagnosis, including:
 - Kernel debugging
 - Kernel dump analysis
 - Debugging multi-threaded applications



CGL Requirements Areas

Clustering and Security



■ Clustering



- Allows use of multiple carrier systems for higher levels of availability through redundant resources and recovery capabilities
- Provide horizontally scaled environment with increased throughput

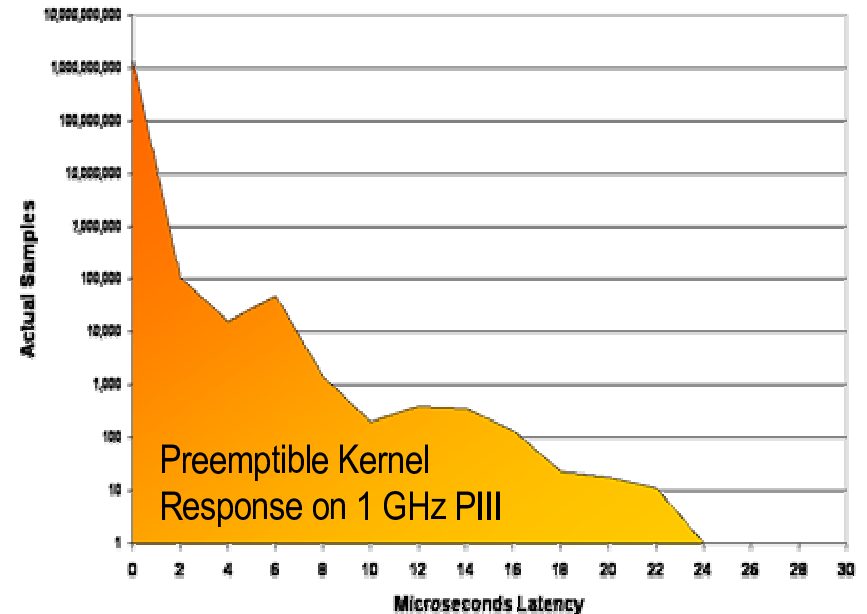
■ Security



- Promotes acceptable levels of security without unreasonable impact on high availability and performance

CGL Requirements Areas Performance

- CGL requires performance to meet carrier needs:
 - Application Pre-Loading
 - RAID Striping support
 - Soft real-time response in 10 ms range (Preemptible Kernel)
- Includes scalability requirements to support vertical and horizontal scaling of carrier systems
 - Provisioning new hardware resources for additional capacity
 - Providing new services with existing hardware resources



Priority 1 Requirements in CGL 2.0



- LSB 1.3 Compliance
- POSIX 2001-1003.1 Compliance Core
- POSIX Barriers, Clock Select, Monotonic Clock, Message Queues, Semaphores, Spin Locks, Threads, Time-outs, Timers, Thread Process-Shared Sync, Synchronization and Scheduling, Robust MUTEXes, Software ECC
- IPv6
- Streaming Control Transfer Protocol (SCTP)
- Persistent Device Naming
- IPMI 1.5 Support
- SAF HPI
- Software Remote Update and Installation
- Software Live Upgrade Minimal Reboot
- Software Live Upgrade RPM Version Check
- Software Live Update Log
- Force Unmount
- Linux Panic Handler Enhancement
- VM Strict Overcommit
- SNMP v1/v2/v3
- SNMP Support for IPv4, IPv6, Baseline MIBs, IPv6 MIBs, IPv6 Kernel Interface - Get
- Efficient Low-Level Asynchronous Events
- Soft Real-time Performance
- Managing Transient Data (Streaming FS)
- Cluster Node Membership with Failure Detection
- Cluster Communication Service - Logical Addressing, Fault Handling
- Password Integrity Checking
- Support for Generic Kernel Security Modules
- IPsec for IPv4
- Support for IKE
- Secure Integrity Check At User-level
- Log Integrity And Origin Authentication Of Logs
- Confidentiality Of Log Information
- Automated Log Analysis
- PKI CA Support

CGL 1.1 Priority 1 Requirements Carried Over into CGL 2.0



- IPv6
- IPSECv6
- MIPv6
- Hot Plug Insertion and Deletion
- Remote Boot Support
- Loading Proprietary Modules
- Diskless Systems
- Serial Console Connection
- Watchdog Time Interface
- Application Heartbeat Monitor
- Ethernet Link Aggregation
- Ethernet Link Failover
- RAID 0/1 Support
- Resilient Filesystem Support
- Disk and Volume Management
- Kernel Message Structuring
- Dynamic Debug / Probe Insertion
- Platform Signal Handler
- Remote Access to Event Log
- User-Level (gdb) Debug
- Support for Threads
- Kernel Debugger

Carrier Grade Linux Specification 3.2

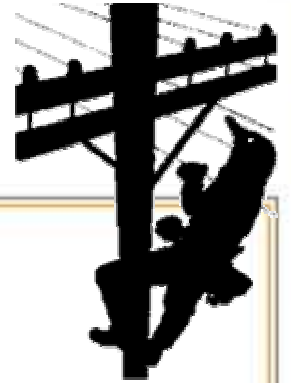
- Important step forward towards building and deploying CGL-based platforms and applications
- Technology Updates
 - Serviceability, Clustering, Performance and Hardware
- Registration
 - CGL 3.0 and 3.1 were for reference and development only.
 - Vendors and distributors can officially register as CGL 3.2 compliant.
 - Allows public disclosure of how they meet each CGL requirements
 - Demonstrates suitability for carrier grade platforms

Emerging Requirements and CRs



- IPMI 2.0 support now available as POC
- Kernel live patching
- Real time support on write
- System initialization error handling enhancement
- Live application dump without significant affect on system/process
- Per thread CPU time limits and signaling
- Task binding to Logical CPU
- Locked page reporting
- Precise process accounting
- Support for mlocked page limit

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OSDL Carrier Grade Linux Initiative

- Goal
 - To accelerate growth and adoption of Linux by supporting requirements of demanding carrier-class applications
- Working Group Membership
 - Hardware Platform Providers
 - Linux Distribution Suppliers
 - Network Equipment Providers (NEPs)
 - Telecommunications Equipment Manufacturers (TEMs)
 - Systems Integrators
 - Carriers
- Activities
 - Collect, Define and Prioritize Technical and Market Requirements
 - Develop Specifications
 - Coordinate Implementation among Members and Community
 - Promote CGL in the Community and Industry.

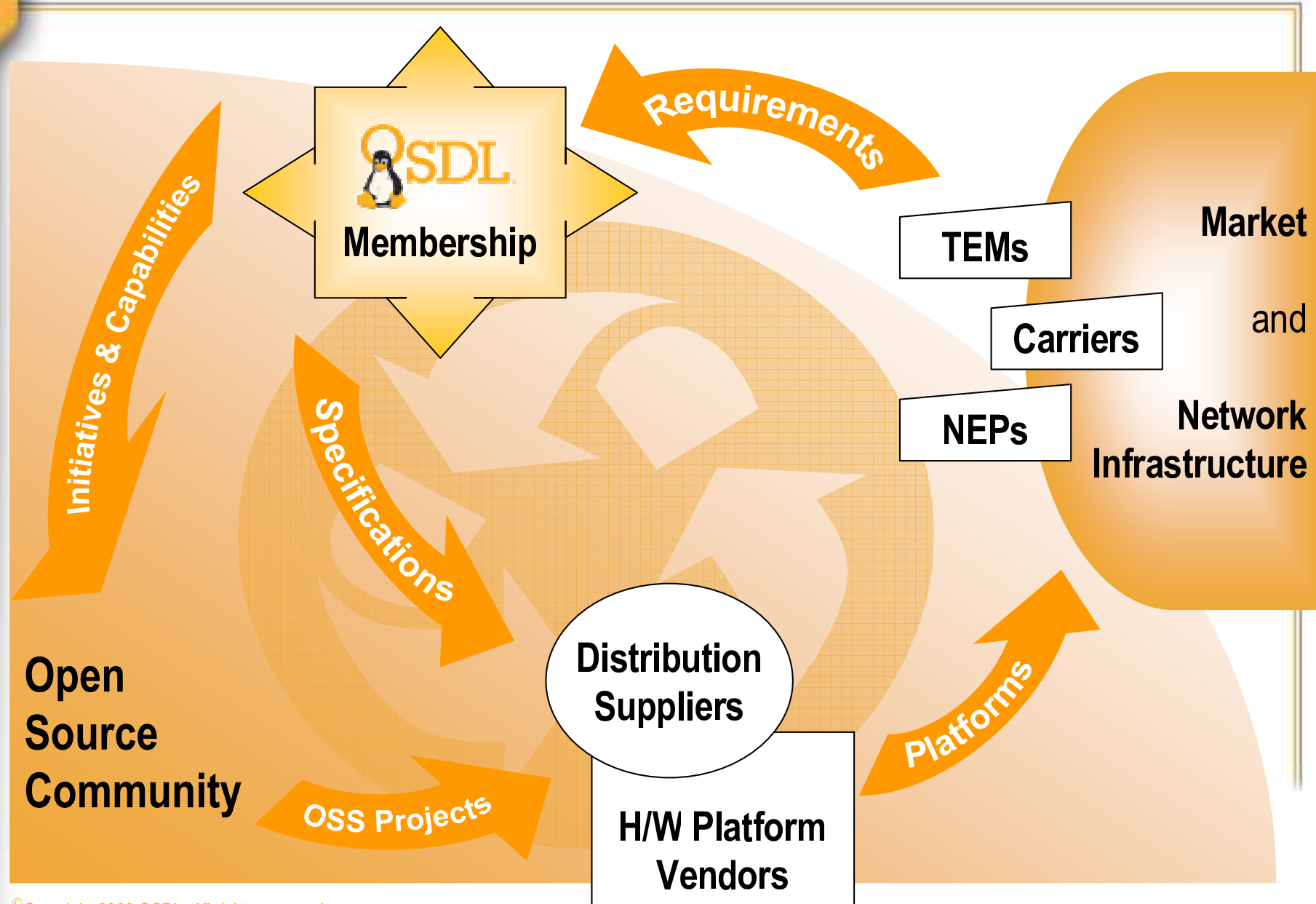
CGL Working Group Sub-Groups

- Specifications Subgroup
 - Collects and Defines requirements for Carrier Grade Enhancements in Linux
 - Categorizes, Prioritizes and Publishes Requirements as CGL Specifications
 - Guide Linux Distribution Suppliers in Delivery of Capabilities
- Proof-of-Concept Subgroup
 - Solicits, Generates and Consolidates Documents detailing CGL Features and Technology
 - Provides Guidelines for Implementation and Integration of Carrier Grade Enhancements in Linux

Carrier Grade Linux Initiative Member Companies

- 10art-ni
- Alcatel
- BT Global Services
- Comverse
- ETRI
- Fujitsu
- Haansoft
- Hitachi
- HP
- IBM
- Intel
- Lynuxworks
- MontaVista Software
- Motorola
- NEC
- Nokia
- Novell
- NTT Corporation
- NTT Data Intellilink
- Red Hat
- Siemens AG
- Timesys
- TurboLinux
- Wind River

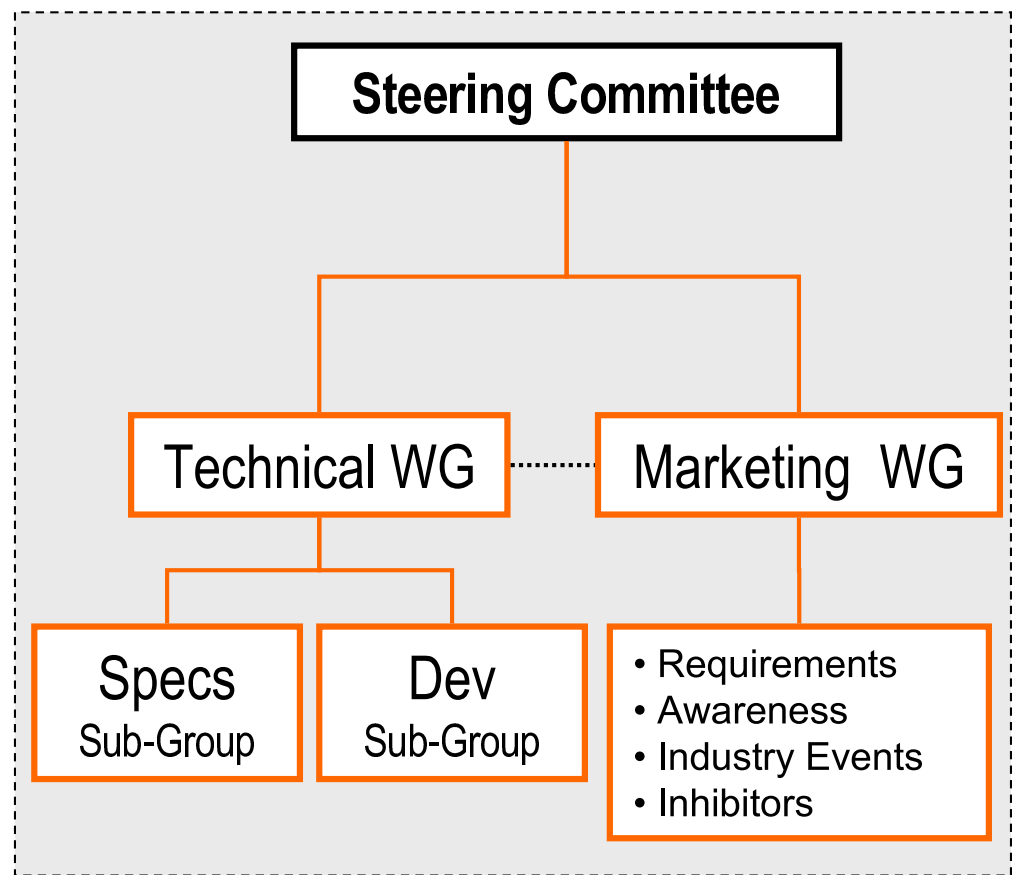
Carrier Grade Linux - Life-cycle Process



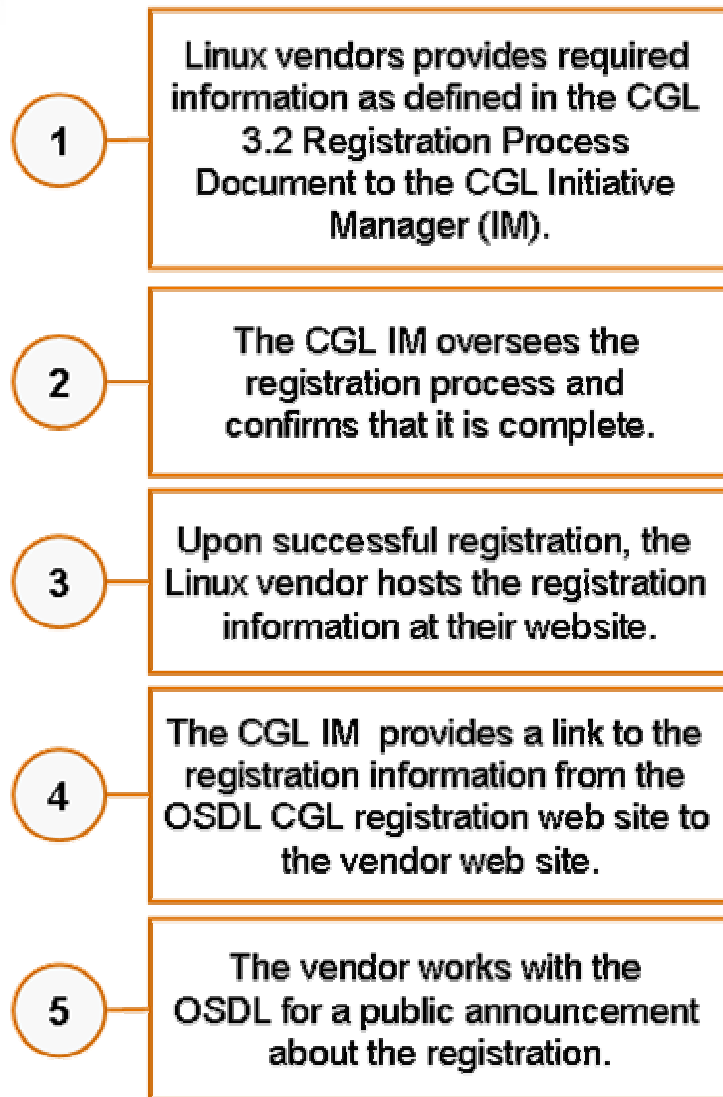
CGL Organization and Leadership Team 2006

Feb 2006 Election

- Steering Chair:
Glenn Seiler (WindRiver)
- Steering Vice Chair:
Peter Badovinatx (IBM)
- Marketing Chair:
Dan Cauchy (MontaVista)
- Tech Board Chair:
Terence Chen (Intel)
- Specs Subgroup Chair:
Mario Smarduch (Motorola)
- Dev Subgroup Chair:
Takashi Ikebe (NTT)

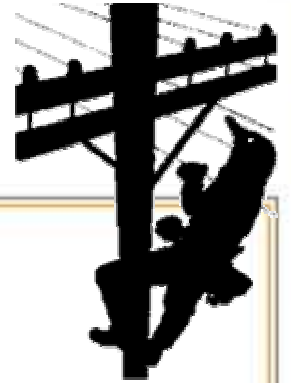


Carrier Grade Linux Registration Process



- Self-Certification Process
- Must meet key existing standards
 - POSIX (base, threading)
 - LSB
 - SA-Forum
- See Registrations at
 - http://www.osdl.org/lab_activities/carrier_grade_linux/registration.html

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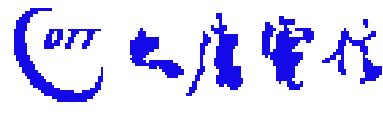
CGL Platforms, Development and Deployment

- Carrier Grade Linux 1.1 Definition (Shipping)
 - MontaVista, Redhat, Suse, TurboLinux, TimeSys, Conectiva
- Carrier Grade Linux 2.0 Definition (Shipping)
 - Asianux, FSMLabs, MontaVista, Novell/SuSE, TimeSys
 - **Wind River**
- Carrier Grade Linux 3.2 Platform
 - Coming Soon : Open as of March, 2006

TEMs, NEPs, Carriers Developing / Deploying with CGL



Agilent



SIEMENS

NEC



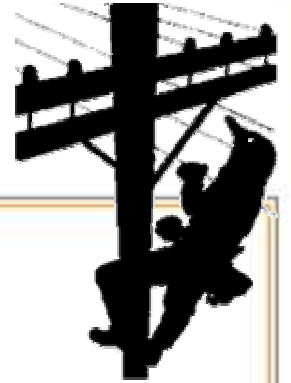
CGL-Related Open Source Projects Today

- OpenAIS (MV, OSDL, Intel, NTT)
- GFS Clusters (RHAT, Sistina, OSDL, community)
- Linux-HA (IBM, Intel, SuSE, community)
- Live update (NTT)
- Boot image fallback (NTT)
- Fast Reboot / kexec (OSDL, community)
- Robust mutexes (Intel, OSDL, community)
- TIPC (Ericsson, OSDL, Intel, Wind River)
- AEM (Ericsson)
- DigSig (Ericsson)
- OpenHPI (IBM, Intel, MV, community)
- OpenIPMI (MV, Intel)
- uSDE (MV, Intel)
- SAF Conformance Tests (Intel, community)
- Forced unmount (coming)
- Cluster-wide logging (coming)

OSDL Engineering Contributions to CGL / DCL

- Clustering
 - TIPC, Event Service
- Fast Reboot
 - kexec
- Multipath I/O
 - DM-based multipath I/O
- Security
 - Security SIG, Security Profiles, LSM (Linux Security Modules)
- Conduit
 - AIO patches, OpenAIS
- Async disk I/O
 - Patch set, Performance
- Network performance
 - Bridge, TCP, NFS
- Stability / Maintenance
 - Janitor, bug fixes, STP/PLM, reaim, aio-stress, LTP, test/patch frameworks

Conclusion



- Carrier Grade Linux is strongly community-based
 - TEMs, NEPs, Carriers supply requirements
 - OSDL members gather requirements and create specifications
 - OSDL members, community and ISVs implement projects
 - Distribution suppliers build and register CGL platforms
 - TEMs, NEPs, Carriers deploy
- Carrier Grade Linux is Real
 - CGL 1.1-based Applications Shipping Worldwide
 - CGL 2.0 Distributions Shipping Today – Applications Follow
 - CGL 3.2 Platforms and Applications in 2006

Q & A : Contact

- Contact:
 - bill@osdl.org
- Slides
 - <http://www.linuxpundit.com>

