



Linux Calling Seminars

**Tux Calling:
Linux in 3G Mobile Phones and Beyond**

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Open Source Development Labs

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May 5 – Helsinki Finland

Hosted by

WIND RIVER

Presentation Abstract

Tux Calling - Linux in 3G Mobile Phones and Beyond

Mobile Handsets OEMs in North America, Europe and Asia are today embracing Linux for a growing array of 2.5G, 3G and WiFi phones in top-tier (smart phone) and mid-tier (feature phone) categories.

This presentation explores the motives behind Linux adoption by companies like Motorola, NEC and Panasonic, as well as emerging Chinese suppliers like Huawei, Datang, and BenQ. It will highlight how these companies met the challenges presented by an initially immature platform, and how they and their peers, as well as OSDL and other .orgs are working to define a solid mobile Linux platform for the next generation of intelligent mobile devices.

Agenda

- Linux Progress in Mobile/Wireless
- Drivers for Linux Adoption in Mobile
 - Technical
 - Market
- Challenges Facing the Linux-based Mobile Ecosystem
 - Technical Gaps
 - Financial and other non-technical Challenges
- OSDL Mobile Linux Initiative



Mobile Handset Market – Tremendous Growth

- 2.6 billion phones expected to be in use worldwide by 2009 (Gartner)
- SmartPhone market growing at a rate of 85 percent annually (IDC)



Three Dozen Linux Phone Models Shipping in 2004-2005 – More to Come in 2006



Datang



e28



e28



Haier



NEC



Panasonic



Motorola



Motorola



Motorola



Motorola



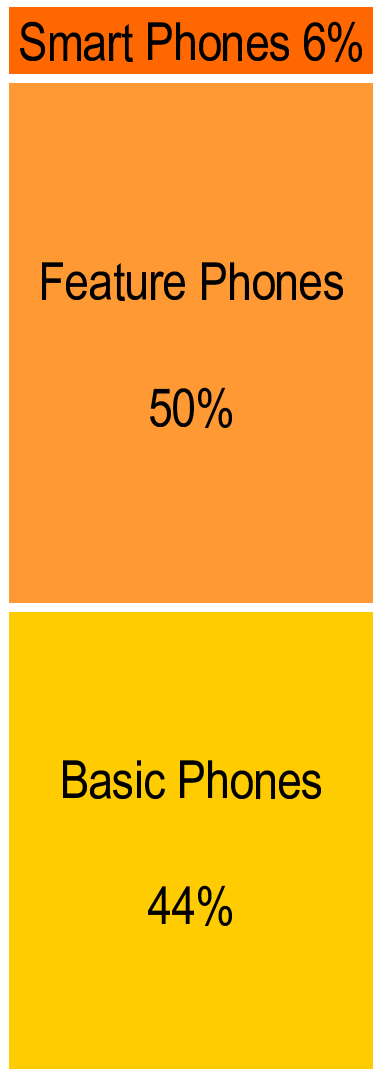
Samsung



Samsung

Phone Market Tiers and Trends: 2005-2010

700 million handsets

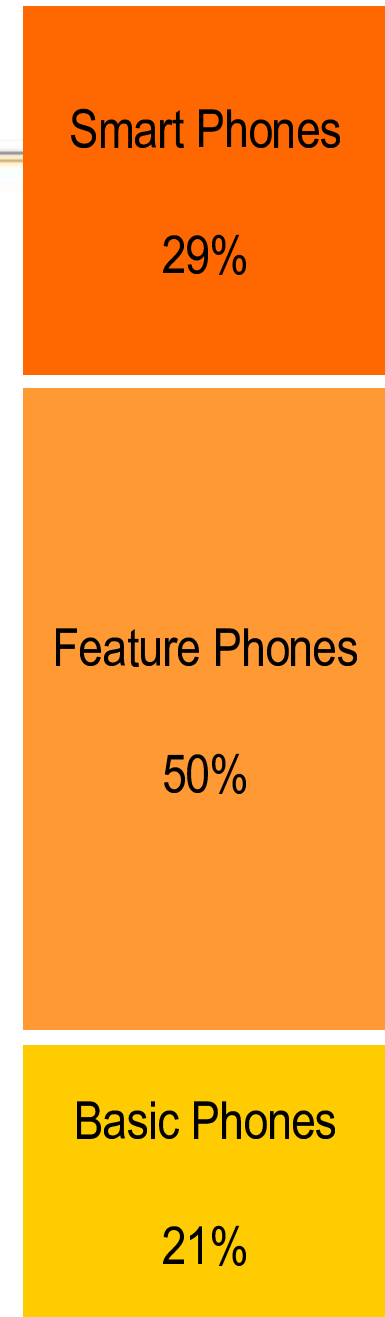


2005

- Strongest Growth
- Highest Margins
- Robust BOM

- Static %, Unit Growth
- Strong Margins
- Falling Unit Price
- Accruing Features

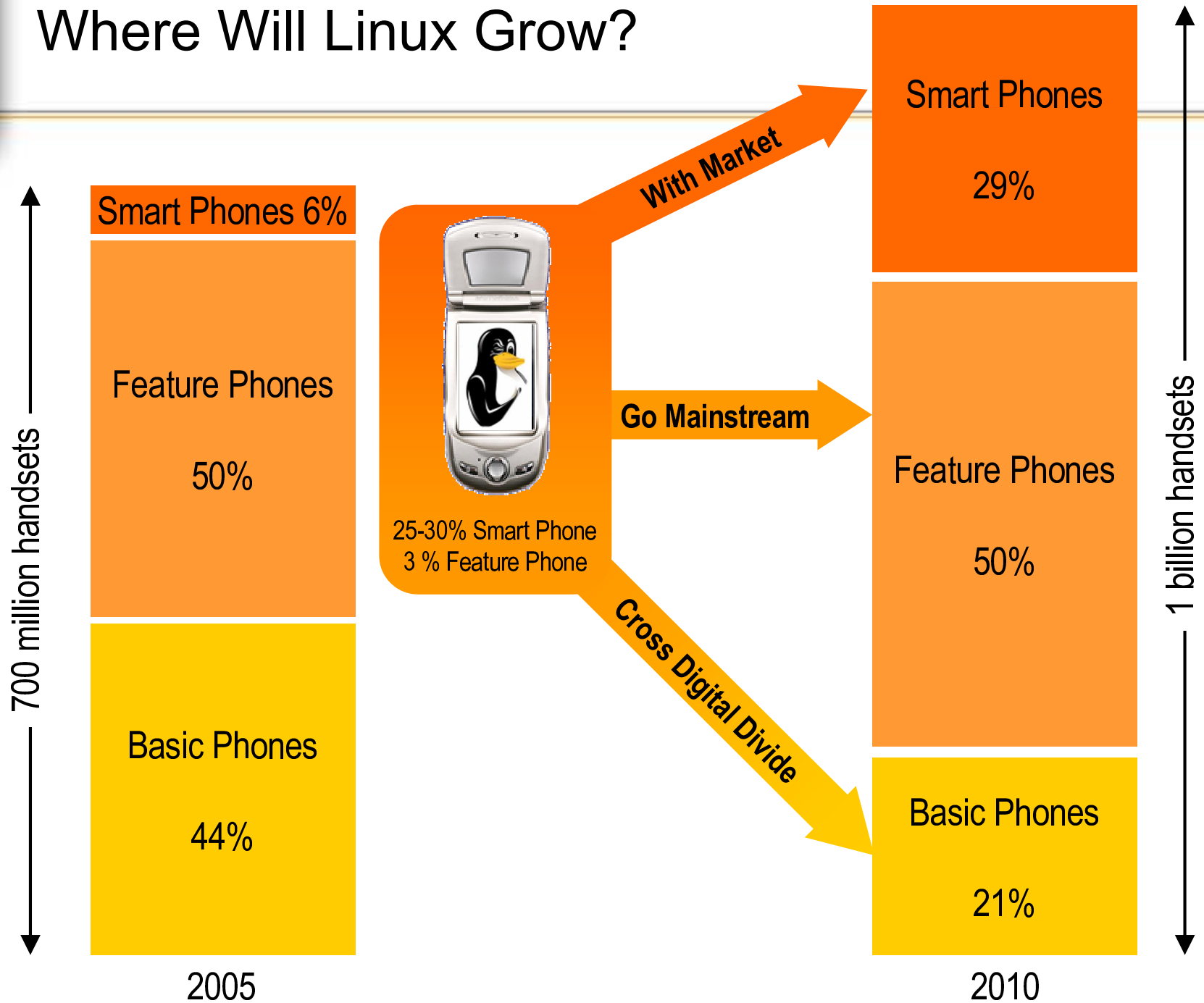
- Shrinking Segment
- Weak Margins
- No Service Growth



2010

1 billion handsets

Where Will Linux Grow?

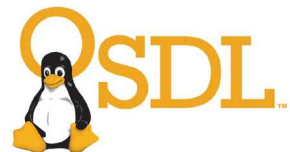


Competition for Linux on Mobile Handsets

- Current / Smartphone
 - SymbianOS
 - Microsoft Windows Mobile 5.0
 - PalmOS (non-Linux)
- Legacy / Mid-tier
 - Brew-REX
 - Nucleus

symbian

Symbian OS - the mobile operating system



MobilePhone OS & Platform Map

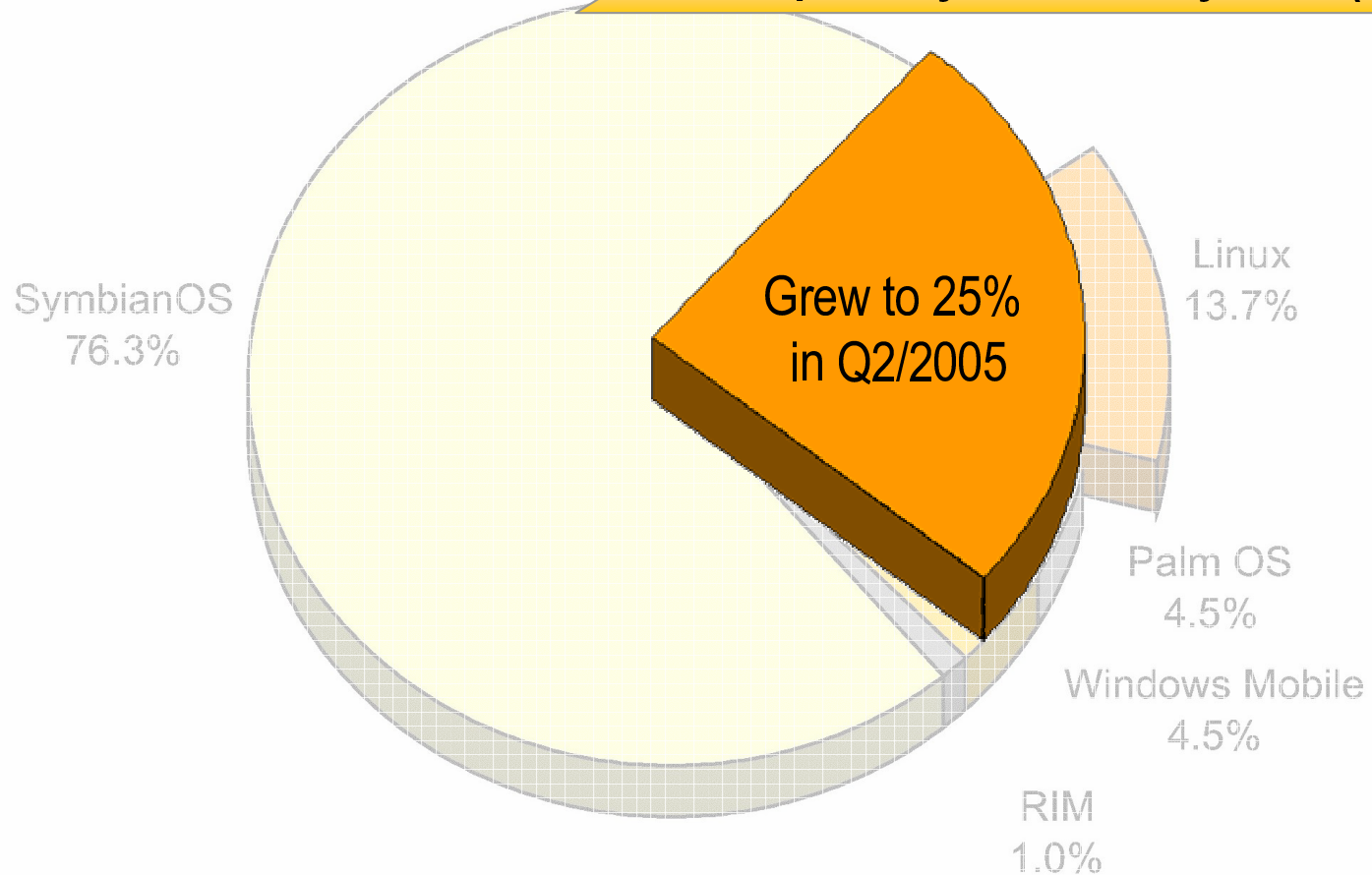
Microsoft Windows	SymbianOS	Linux	BREW
	<p><i>NTT DoCoMo</i></p> <p>Fujitsu MELCO Sharp Panasonic (Overseas)</p>		<p>Sanyo</p>
	Nokia		<p><i>KDDI</i></p> <p>CASIO Pantech Kyocera Sanyo Toshiba</p>
	Siemens	BenQ	
	Sony Ericsson		
	Motorola		<p>NEC (for China)</p>
	<p>LG Electronics</p>		
	<p>Samsung</p>		

Data from Impress *K-tai OS & Platform Research Report 2005* and other sources

Linux Strong in SmartPhones

Smartphone Marketshare – Q1/2005

Linux and WindowsMobile projected to surpass SymbianOS by 2010 (TGD)



Linux : 412% growth from 3.4% in Q1/2004

Worldwide Unit Shipments 2005 Q2 and Q2 – Source: Gartner

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Technical Drivers for Mobile Linux Adoption

- Unified “Strategic” Product Platform
 - Device OEMs can have 3-6 legacy OSes, stacks, tool sets
 - Platform diverges across products, networks, regions
 - Need to unify training, support, expertise/headcount
 - Base platform design developed by CTO office
- Surging Software Content
 - Handset LoC doubling every year
 - Need OS / platform capable of hosting large/complex loads
- Flexibility throughout the stack
 - Multiple options for Linux platform, CPU support
 - Choice in graphics, middleware
 - Freedom to mix legacy apps, commercial and free software

Non-technical Drivers for Mobile Linux Adoption

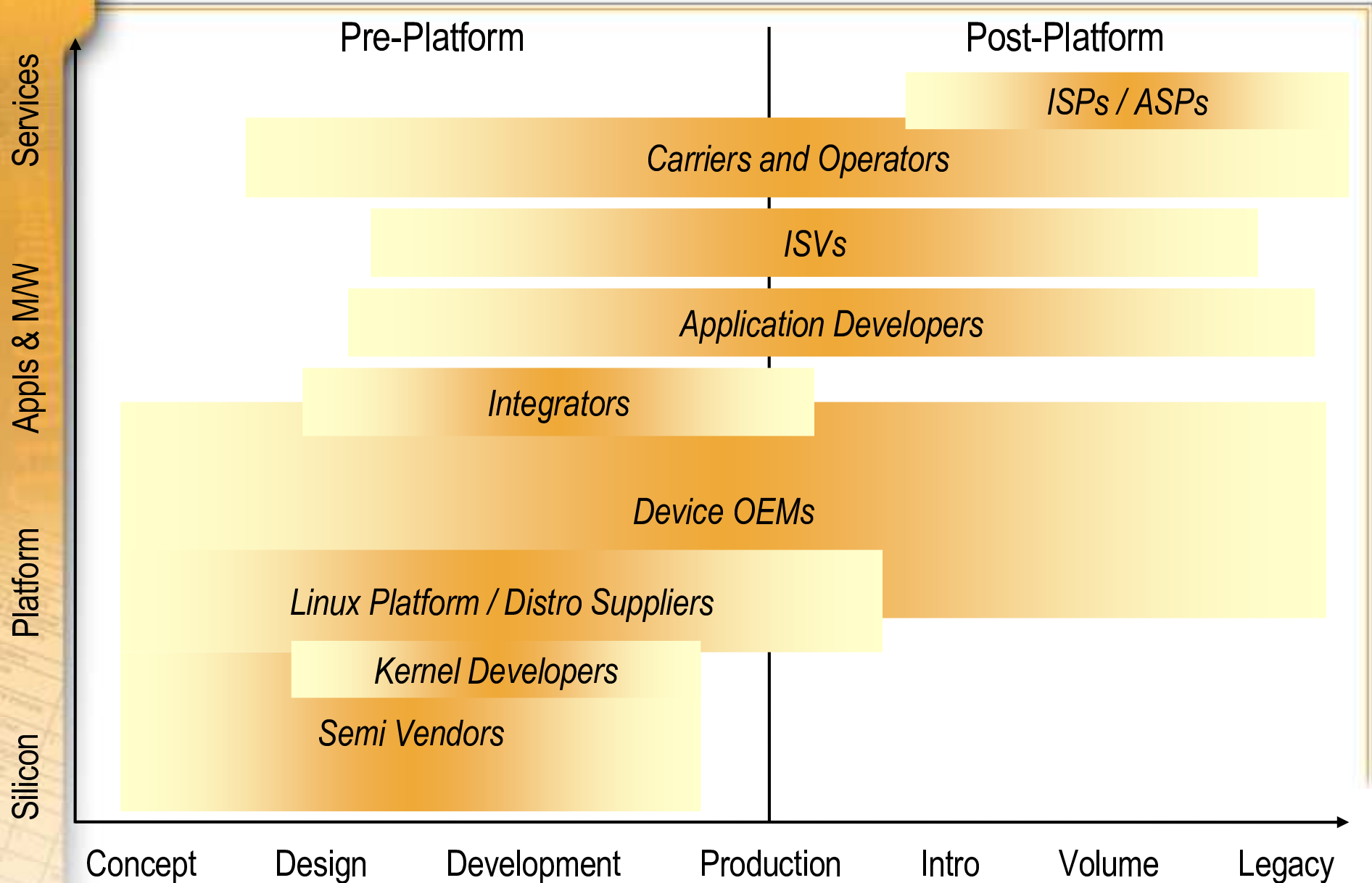
- Reduced deployment costs and vendor lock-in
 - Royalty-free base platform
 - Multiple sources for m/w and applications
 - Help improve margins / lower MSRP in non-subscription markets
- Room to differentiate
 - Linux brand equity is “friendlier” than Microsoft
 - Allows Tier I OEMs to brand, skin, “own” platform
- Lowers Barriers to Entry into Marketplace
 - Using SymbianOS incurs high design / licensing costs
- Ecosystem Development around Phone “Platforms”
 - Carriers, Operators, ISVs can add services/applications to standards-based handsets

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Pre- and Post-Platform Ecosystems



Challenges to Linux Adoption in Mobile Telephony

Technical

- **Development Tools***
- Device Drivers
- Multimedia Framework
- **Performance***
- **Power Management***
- **Security***
- **Storage***
- Wireless Networking

Non-technical

- Legal and Regulatory Concerns
- Silicon Provider Alignment
- Fragmentation / Harmonization
- Mainstreaming

*Focus areas for OSDL MLI in 2006



Development Tools

- Current tools sets “good enough”
 - Standard C, C++ and Java development tools
 - Increasing integration into Eclipse

Tools Requirements / Wish List

Handset prototyping / simulation tools

Performance optimization

Boot time, real-time, foot-print analysis, shared libraries

Security testing tools

Systems vs. applications development



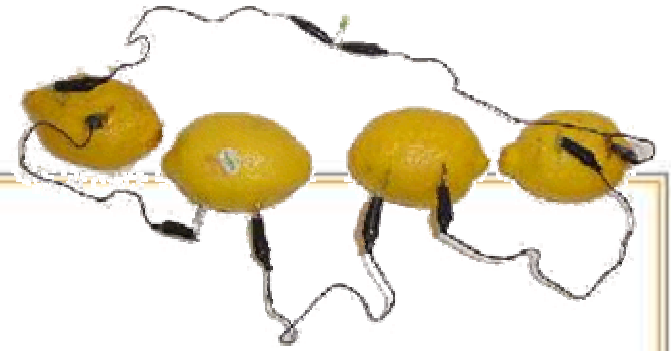
Technical Challenges

Performance

- Boot time
 - Cold boot and return from suspend
 - Boot to init in under 200 ms, but then what?
- Real-time
 - Interrupt and Preemption Latency
 - Context switch
 - Complex scheduling, priority inheritance, RMA . . .
- Networking
 - Wireless WAN, WiFi LAN, cradle-based
 - Performance over mixed media (e.g., *oUSB)
- Impact of PM Policy on Performance
 - Changes in latency, throughput
- Single Core vs. Multi-core Implementations
 - Symmetric on dual-core vs. partitioned
 - Multimedia/base-band on application processor vs. dedicated cores



Power Management



- Current Power/Energy Paradigms Divergent
 - Desktop / Notebook : apm, acpi, PMU, Transmeta Longrun
 - Server / Blade : thermal management
 - Embedded / Mobile
 - ARM IEM and ARM licensee schemes
 - Low-level H/W power management
 - Dynamic Power Management (MontaVista, CELF et al.)
- Handset OEMs express needs to
 - Unify Power Management landscape
 - Establish standard APIs (kernel and user space)
 - Standardize PM policy / management

Security

- Platform Security
 - Device kernel security
 - Platform update process in fielded handsets
- Application Security
 - Base applications supplied with device
 - Applications delivered via carriers/operators
 - Third party and/or Open Source applications
- Network Security
 - Operator/Carrier Wireless Networks
 - Local wireless networks (data and voice)
 - WiFi
 - BlueTooth
 - Identity issues, spoofing
- Physical Security
 - Local exploits via flash, “cooking”, etc.

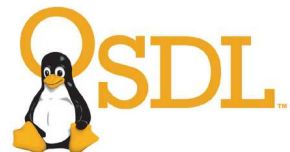


Technical Challenges

Storage



- Secure Platform Image
- Field Update
 - Applications vs. platform
- Flash Performance and Efficiency
 - Multiple flash file systems : JFFS2, CramFS, YAFFS
 - Need to support NAND and NOR
 - Options for execute-in-place (XIP)
 - How to support proprietary media formats
- Local vs. Remote Persistence



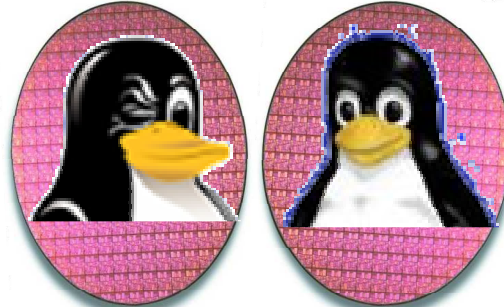
Legal and Regulatory Concerns



- Device Certification
 - Handsets are certified “as shipped”
 - How open can a phone be w/o de-certifying?
 - User-space applications? Device drivers? Kernel?
- FCC Limitations on RF Emissions
 - Tweaked driver settings could boost power
 - General issue for all s/w-defined radio (SDR) technology
 - Closed-source wireless drivers and the GPL
- Other Regulatory Regimes
 - SOX, etc.

Silicon Providers and Linux Fragmentation

- Many/most silicon vendors provide a Linux distro
 - From a full platform to a bare kernel (“bucket o’bits”)
 - Some roll their, some work with distro suppliers
 - Versions vary across vendors & architectures
- Where do device OEMs get their Linux?
 - Silicon vendors, distro suppliers, free distros, kernel.org



Mainstreaming Mobile-specific Technology

- Embedded-targeted features begin life as forks
 - JTAG/BDM support
 - Preemptible kernel and robust mutexes
 - Many device drivers
 - Patches for size optimization (e.g., -tiny, uclibc)
- How to streamline acceptance into kernel mainline?
 - Dilemma for OSDL, CELF, LiPS, OEMs
 - Device OEMs often lack OSS community experience / ties
 - Recourse of hiring known developers
 - E.g., CELF and Matt Mackall

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OSDL Mobile Linux Initiative - Mission

Accelerate Linux adoption in the mobile space:

- Identify and address technical and non-technical industry requirements
- Create and foster implementations in open source
- Advocate/explain industry needs to the kernel/open source community
- Promote mobile Linux (including education of Carriers about benefits of open source)
- Clarify legal and regulatory issues surrounding mobile phones as they relates to Linux and open source
- Enable and foster pre-platform developer ecosystem*

*Creating/enhancing Linux; enabling aftermarket development & ISVs deferred for 2006



MLI Workgroup Membership – May 2006

ETRI

FUJITSU



KIPA
Korea IT Industry Promotion Agency

montavista™

 **mizi**



NEC

NTT

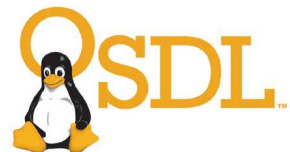
palmsource™

SIEMENS

SPREADTRUM™

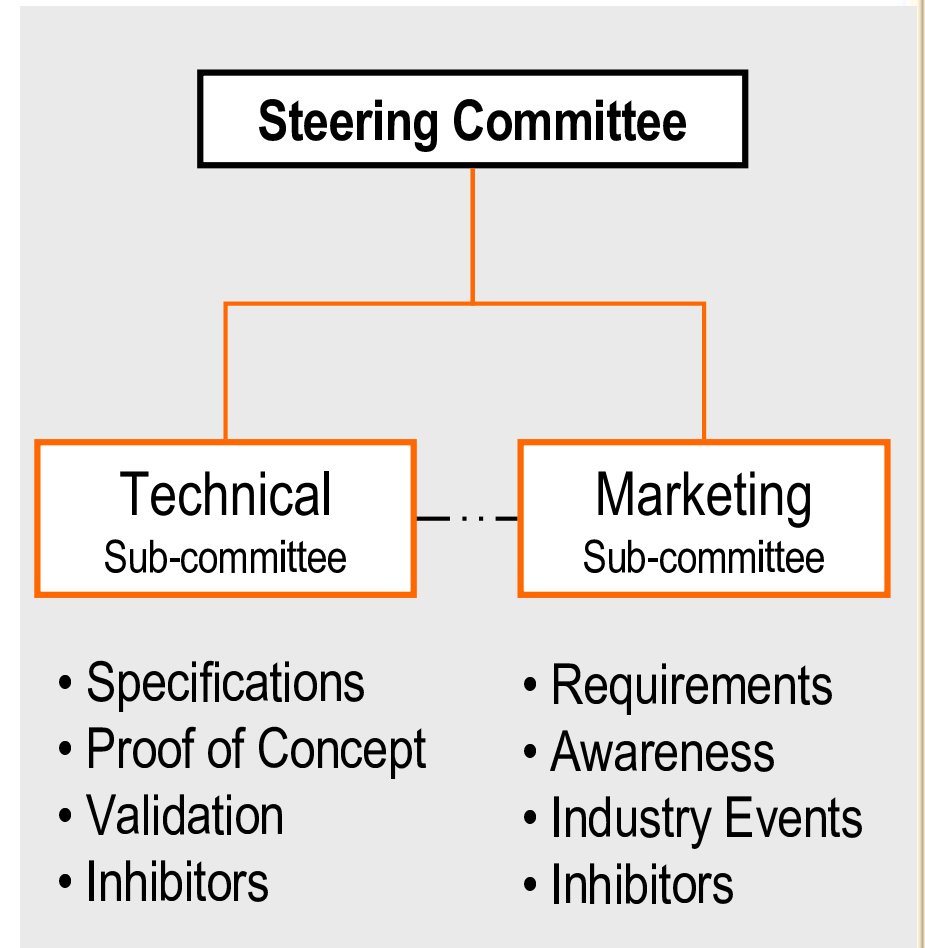
TROLLTECH

WIND RIVER



MLI Structure and Governance

- Steering Chair
 - John Ostrem, PalmSource
- Technical Chair
 - Rob Rhoads, Intel
- Marketing Chair
 - Christopher Zapf, Wind River



Other .orgs in Linux Mobile Telephony

- CELF – Consumer Electronics Linux Forum

- Founded in 2002 by Sony, Matsushita (Panasonic) et al.
- Main focus lies with consumer devices
- Also has “Mobile Phone Profile” work group
- About to publish API set



- LiPS – Linux Phone Standard Forum

- Found in 2005 by France Telecom, Orange, others
- Main focus in APIs for carrier service delivery
- Leverage Linux as a platform but not 100% focused on Open Source

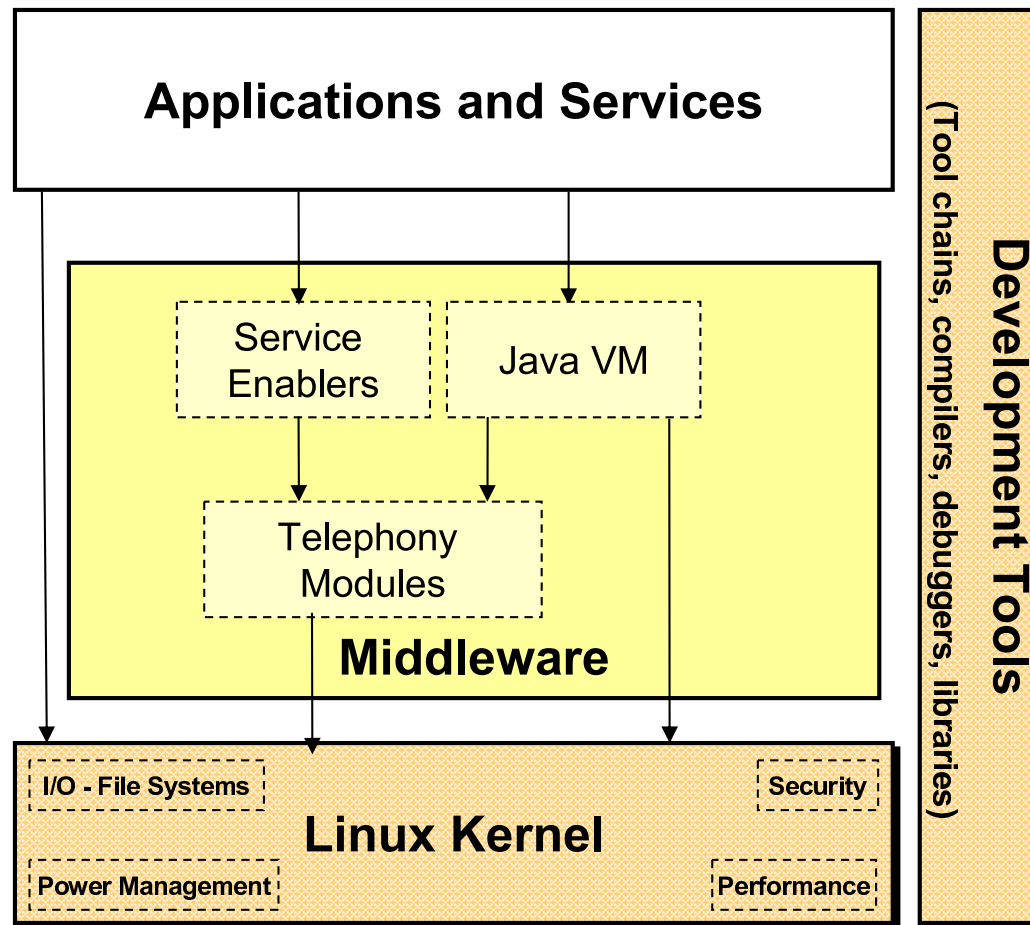


- OSDL Management and MLI working closely with both bodies

- Multiple members in common
- Trying to avoid duplication and fragmentation



Architecture and MLI Focus for 2006



MLI 2006 Technical Priorities:

- Power Management
- File Systems
- Performance
- Security
- Development Tools

 **MLI Focus area for 2006**

Open (Ended) Questions

- How open should phones become?
 - Support (commercial) applications and services
 - Allow in-channel customization?
 - Permit end-user modification?
- Are Mobile Phones “general purpose” computing devices?
 - Key question in licensing debates
- How will ubiquitous WiFi and VoIP change the mobile marketplace?
 - Impact on carriers and operators
 - De-regulation of existing markets

Conclusion

- Linux Adoption Strong and Growing Mobile Telephony
 - Strongest in “Smart Phones” and high-end “Feature Phones”
- Vendors / Developers Banding Together
 - Meet shared challenges (for phones and beyond)
 - Help widen adoption
- (Re)Defining the Notion of Intelligent Device
 - Open for Ecosystem Value-Add
 - Open for Open’s Sake?

Q & A : Contact

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