

# **Current Trends and Future Prospects of Linux in Embedded Arena**

# Agenda

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- **Introduction**
- **Generic Linux Requirements for Embedded Systems**
- **Linux Salient Features**
- **Linux Drawbacks for Hard Real Time Systems**
- **Embedded Linux Market Trends**
- **Some Directions for Future Developments**

# Introduction

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- ❖ **Linux Vs Embedded Linux**
- ❖ **Choices of Embedded Linux Kernel**
- ❖ **Generic Linux Requirements for Embedded Systems**
- ❖ **Carrier Grade Linux (CGL) Specifications**
- ❖ **Consumer Electronic Linux Forum (CELF) Specification**

# Linux Benefits

- ❖ **GPL**
- ❖ **Vendor Choice Options**
- ❖ **Open Source Tools**
- ❖ **POSIX Compatibility**
- ❖ **Scalability**
- ❖ **Robustness**
- ❖ **Highly Configurable Kernel**

# Salient Features

## ➤ Low Footprint

- ❖ Kernel Configuration
- ❖ CRAMFS, SquashFS, JFFS2
- ❖ Provision to remove MMU subsystem

## ➤ Fast Booting

- ❖ XIP (partial XIP)
- ❖ Calibrate Delay Avoidance
- ❖ IDE NoProbe

## ➤ Secure Data by PRAMFS

# Salient Features

## ➤ **POSIX IPC**

- ❖ **Message Queue**
- ❖ **Shared Memory**
- ❖ **Semaphore**
  - **Named**
  - **Unnamed**

## ➤ **High Resolution Timers**

- ❖ **Nano sleep**
- ❖ **Interval Timers**

# Salient Features

- **POSIX Real Time Signals**
- **Efficient Power Management**
  - ❖ **Device Power Management**
  - ❖ **Platform Power Management**
  - ❖ **Variable Scheduling Timeout**
- **Hyper Threading Support**
- **Higher Priority Range of Real Time Processes**

# Salient Features

- **Fully Preemptible Kernel**
  - ❖ **Sleeping Spinlock**
  - ❖ **Interrupt Thread**
  - ❖ **Priority Inheritance**
  - ❖ **Fine Grained Kernel Locking Mechanisms**
  - ❖ **Lock Validator**

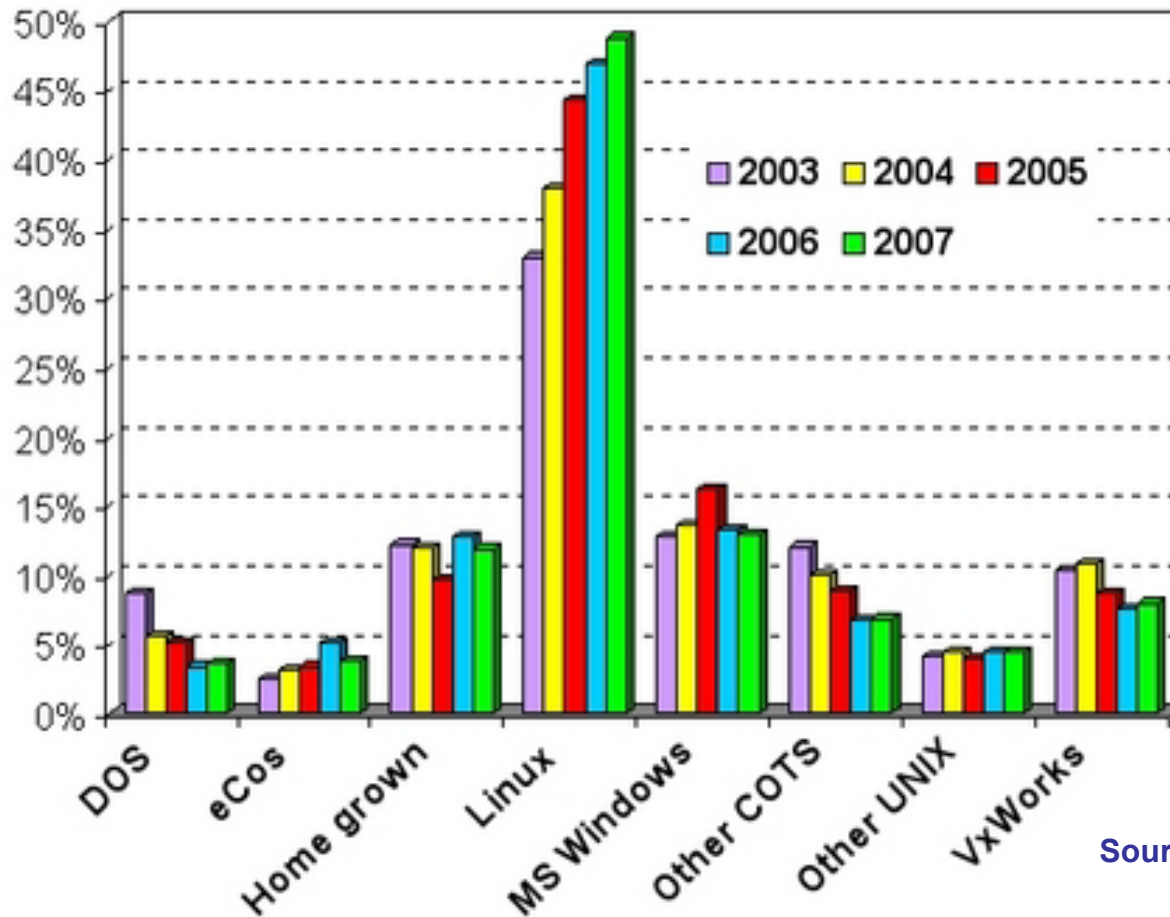


# Drawbacks for HRT

- **Monolithic Kernel**
- **~15 microsecond response time**
- **Non-Deterministic Kernel Services**
  - ❖ **System Call Execution**
  - ❖ **Device Driver**
  - ❖ **Memory Allocation**
- **Lack of Cross Development Tools**

# Marketing Trends

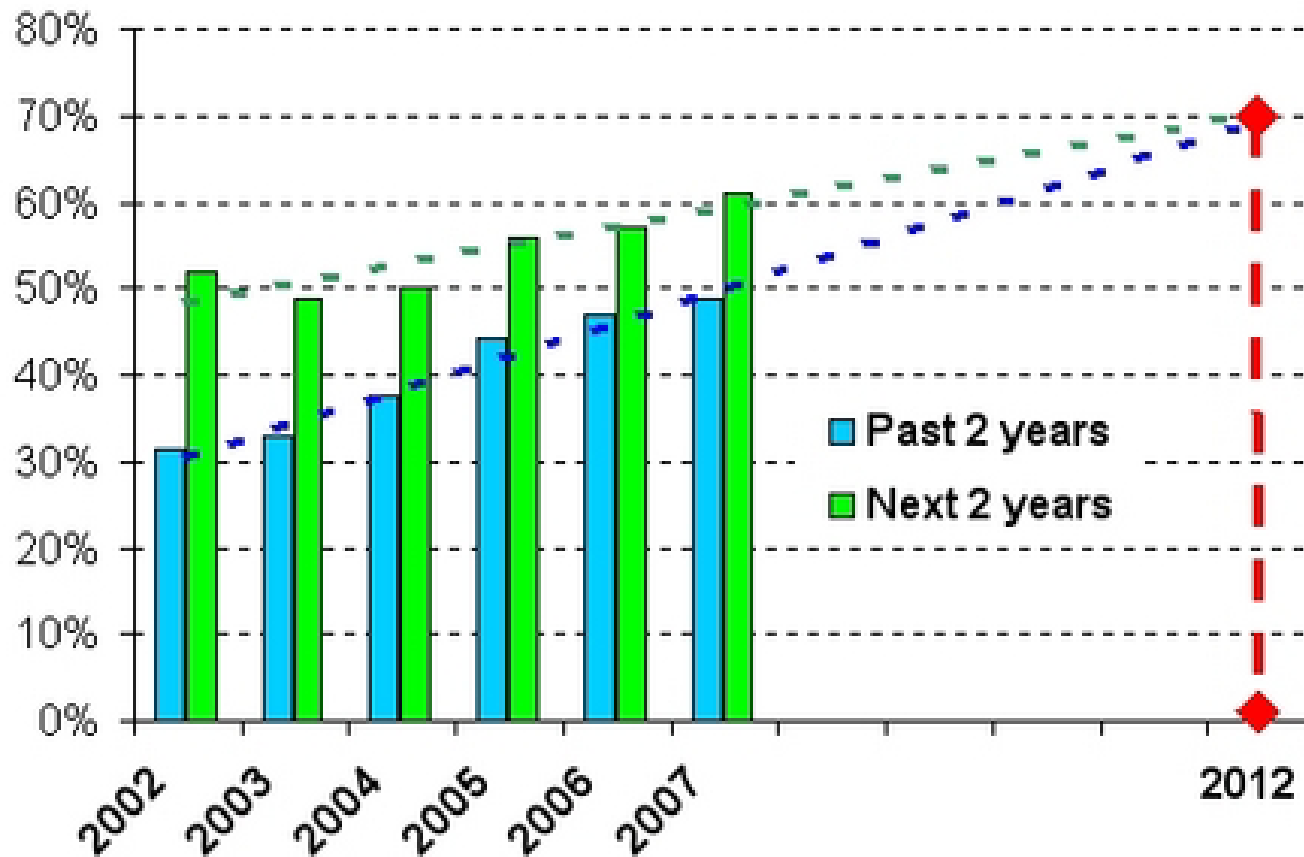
Embedded OS sourcing trends



Source: [linuxdevices.com](http://linuxdevices.com)

# Marketing Trends

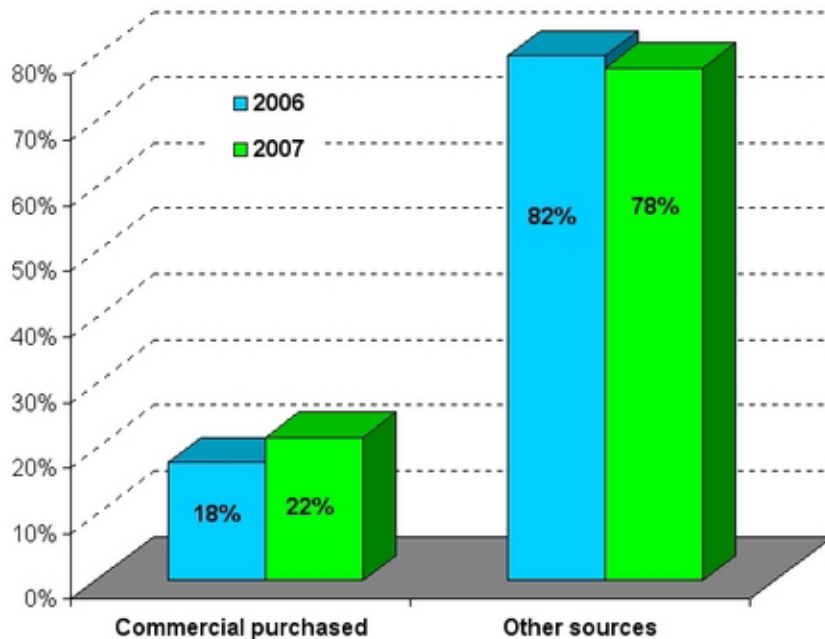
Past/future Linux use



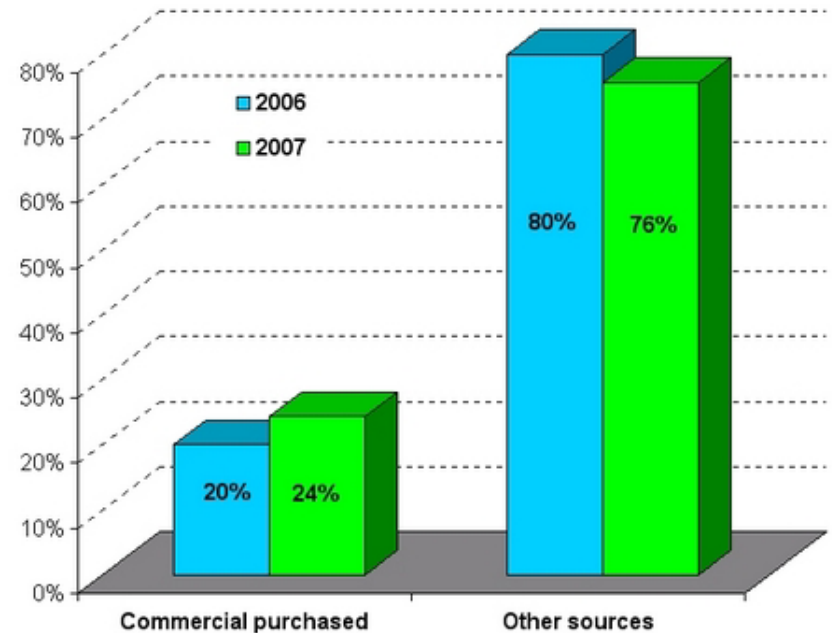
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# Marketing Trends

**Embedded Linux OS Sourcing Trend - Current Use**



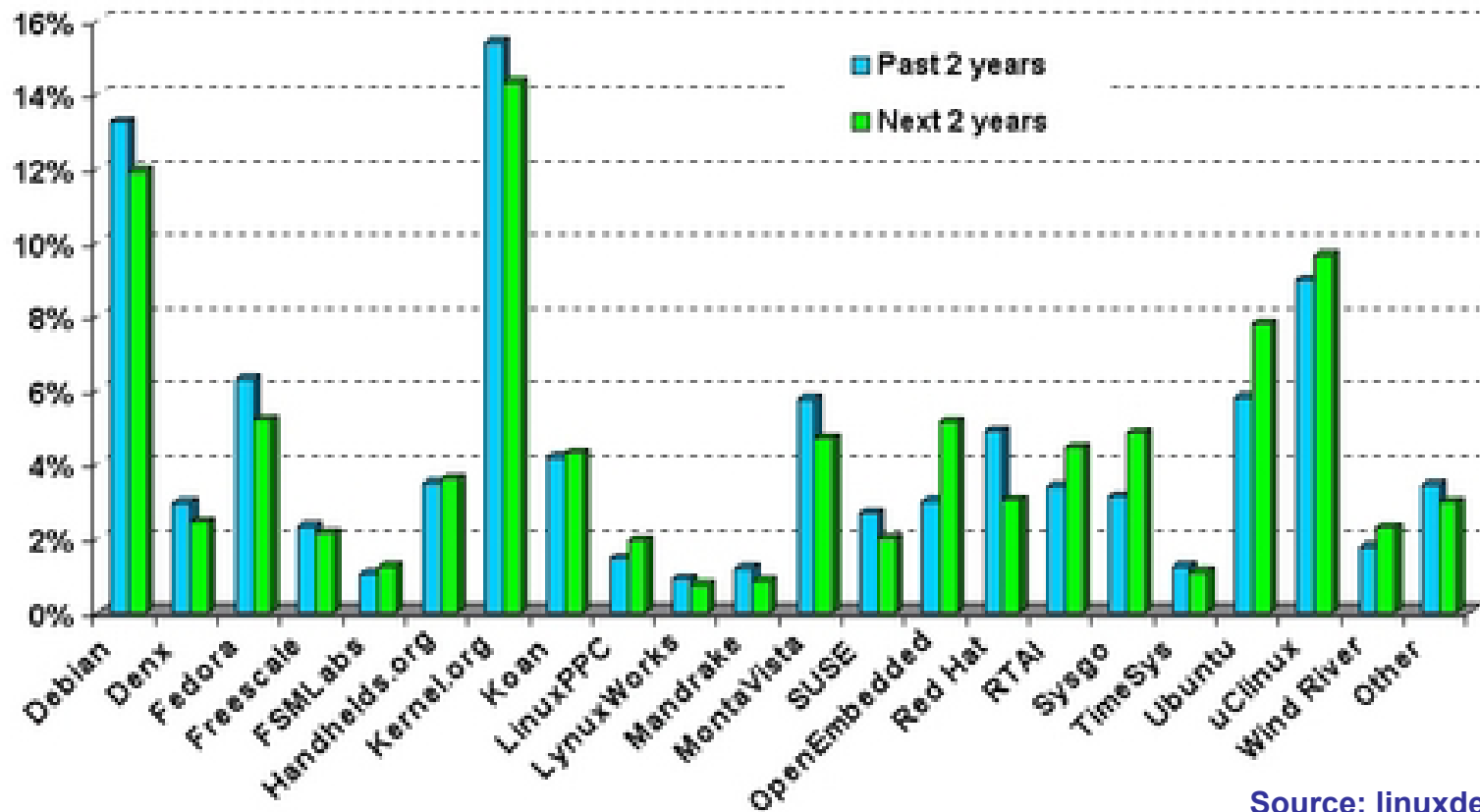
**Embedded Linux OS Sourcing Trend - Future Plans**



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# Marketing Trends

Embedded Linux OS sourcing trends



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# Future Developments

- **Micro / Nano Kernel Approach**
  - ❖ **Separate Kernel Maintenance and mailing List**
- **Hardware Software Co-Design**
  - ❖ **Embedded Linux on Chip**
- **International Certification for Developers**
- **Test Suites for Real Time Characteristics**
- **More Efficient Debugging Features**
- **Better Cross Development Tools**

# ***Thank You***

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