Introduction

References and Presentation at:
http://www.elinux.org/SOC_Spies
Introduction

- Dave Anders aka prpplague
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- Dave Anders aka prpplague
- Currently Contracted with CircuitCo
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- Dave Anders aka prpplague
- Currently Contracted with CircuitCo
- Partners in TinCanTools
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- Dave Anders aka prpplague
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- Double-Agent Developer: ARM vs. X86
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- Double-Agent Developer: ARM vs. X86
  - NOT Flame Fest
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  - NOT representing any company or organization
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  - NOT Flame Fest
  - NOT representing any company or organization
  - NOT promoting one architecture over another
Introduction

- Dave Anders aka prpplague
- Currently Contracted with CircuitCo
- Partners in TinCanTools
- Double-Agent Developer: ARM vs. X86
  - Historical Perspective
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  - Historical Perspective
  - General Pros/Cons
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- Partners in TinCanTools
- Double-Agent Developer: ARM vs. X86
  - Historical Perspective
  - General Pros/Cons
  - Practical Considerations
Historical Perspective

- Embedded in 1999
Historical Perspective

- Embedded in 1999
  - Geode
  - STPC
  - i486
Historical Perspective

- Embedded in 1999
- TCS-X1
Historical Perspective

- Embedded in 1999
- TCS-X1
- ITSY
Historical Perspective

- Embedded in 1999
- TCS-X1
- ITSY
  - Design Files
  - Linux Support
  - ARM Based
Historical Perspective

- Embedded in 1999
- TCS-X1
- ITSY
- PandaBoard
Historical Perspective

- Embedded in 1999
- TCS-X1
- ITSY
- PandaBoard
  - Design Files
  - Linux Support
  - ARM Based
Historical Perspective

- Embedded in 1999
- TCS-X1
- ITSY
- PandaBoard
  - Intel x86???
Historical Perspective

- Embedded in 1999
- TCS-X1
- ITSY
- PandaBoard
- MinnowBoard
- MinnowBoard Max
Historical Perspective

- Embedded in 1999
- TCS-X1
- ITSY
- PandaBoard
- MinnowBoard
- MinnowBoard Max
  - Design Files
  - Linux Support
  - IA 64-bit
Historical Perspective

- Embedded in 1999
- TCS-X1
- ITSY
- PandaBoard
- MinnowBoard
- MinnowBoard Max
- X86 and ARM Designs
Historical Perspective

- Embedded in 1999
- TCS-X1
- ITSY
- PandaBoard
- MinnowBoard
- MinnowBoard Max
- X86 and ARM Designs

Experiences and opinions represented here are from my personal perspective of creating open source hardware designs that first and foremost run Linux.
General Pros/Cons

- x86 Pros
General Pros/Cons

- x86 Pros – Uniformity
General Pros/Cons

- x86 Pros – Uniformity
  - Decades spent working on uniformity
General Pros/Cons

- x86 Pros – Uniformity
  - Decades spent working on uniformity
  - Component Vendor infrastructure
General Pros/Cons

- x86 Pros – Uniformity
  - Decades spent working on uniformity
  - Component Vendor infrastructure
  - Reference Designs
x86 Pros – Uniformity
- Decades spent working on uniformity
- Component Vendor infrastructure
- Reference Designs #exactsteps
General Pros/Cons

- x86 Pros – Uniformity
  - Decades spent working on uniformity
  - Component Vendor infrastructure
  - Reference Designs #exactsteps

Here is a reference design, if you use it exactly as given, it will work!
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
General Pros/Cons

- **x86 Pros** – Uniformity
- **ARM Pros** – Flexibility
  - No one enforcing compatibility
**General Pros/Cons**

- **x86 Pros** – Uniformity
- **ARM Pros** – Flexibility
  - No one enforcing compatibility
  - Open Vendor interaction
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
  - No one enforcing compatibility
  - Open Vendor interaction
  - Reference Designs
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
  - No one enforcing compatibility
  - Open Vendor interaction
  - Reference Designs #rtfm
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
  - No one enforcing compatibility
  - Open Vendor interaction
  - Reference Designs #rtfm

Here is a reference design with one example of implementation and if you change it, you better check the datasheet!
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility

The things that provide the greatest strengths for both ARM and x86 are also their greatest weaknesses.
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
- x86 Cons
  - Rigid adherence standards
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
- x86 Cons
  - Rigid adherence to standards
  - Lack of vendor interaction
General Pros/Cons

- **x86 Pros** – Uniformity
- **ARM Pros** – Flexibility
- **x86 Cons**
  - Rigid adherence standards
  - Lack of Vendor interaction
  - Lack of Design variations
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
- x86 Cons
- ARM Cons
General Pros/Cons

- **x86 Pros** – Uniformity
- **ARM Pros** – Flexibility
- **x86 Cons**
- **ARM Cons**
  - Lack of standards enforcement
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
- x86 Cons
- ARM Cons
  - Lack of standards enforcement
  - Lack of vendor compliance
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
- x86 Cons
- ARM Cons
  - Lack of standards enforcement
  - Lack of vendor compliance
  - Lack of Design validation
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
- x86 Cons
- ARM Cons
- Pathway Forward
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
- x86 Cons
- ARM Cons
- Pathway Forward
  - x86 → embedded
  - ARM → server
General Pros/Cons

- x86 Pros – Uniformity
- ARM Pros – Flexibility
- x86 Cons
- ARM Cons

Pathway Forward
- x86 → embedded – relaxing standards - easy
- ARM → server
General Pros/Cons

- **x86 Pros** – Uniformity
- **ARM Pros** – Flexibility
- **x86 Cons**
- **ARM Cons**
- Pathway Forward
  - **x86 → embedded** – relaxing standards - easy
  - **ARM → server** – enforcing standards - hard
Practical Considerations

- Hardware
Practical Considerations

- **Hardware**
  - Component Count (Pro-Arm/Con-x86)
Practical Considerations

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  - Component Count (Pro-Arm/Con-x86)

BeagleBone Black
18 Unique Values
131 Total Resisors
**Practical Considerations**

- **Hardware**
  - **Component Count (Pro-Arm/Con-x86)**

  - **BeagleBone Black**
    - 18 Unique Values
    - 131 Total Resisors

  - **MinnowBoard Max**
    - 73 Unique Values
    - 322 Total Resisors
Practical Considerations

- Hardware
  - Component Count (Pro-Arm/Con-x86)
Practical Considerations

- Hardware
  - Component Count (Pro-Arm/Con-x86)
Practical Considerations

- Hardware
  - Component Count (Pro-Arm/Con-x86)
  - Power Supplies (Pro-x86/Con-ARM)
Practical Considerations

- Hardware
  - Component Count (Pro-Arm/Con-x86)
  - Power Supplies (Pro-x86/Con-ARM)
    - Use without dedicated PMIC
    - Robust fault tolerance
    - Wide component selection
Practical Considerations

- **Hardware**
  - Component Count (Pro-Arm/Con-x86)
  - Power Supplies (Pro-x86/Con-ARM)
  - Peripherals (Pro-ARM/Con-x86)
Practical Considerations

- **Hardware**
  - Component Count (Pro-Arm/Con-x86)
  - Power Supplies (Pro-x86/Con-ARM)
  - Peripherals (Pro-ARM/Con-x86)
    - Limited component selection
    - Gige PHY on MinnowBoard
    - Codec on MinnowBoard
Practical Considerations

- Hardware
  - Component Count (Pro-Arm/Con-x86)
  - Power Supplies (Pro-x86/Con-ARM)
  - Peripherals (Pro-ARM/Con-x86)
  - Peripherals (Pro-x86/Con-ARM)
Practical Considerations

- **Hardware**
  - Component Count (Pro-Arm/Con-x86)
  - Power Supplies (Pro-x86/Con-ARM)
  - Peripherals (Pro-ARM/Con-x86)
  - Peripherals (Pro-x86/Con-ARM)
    - Too many options
    - Lack of example configurations
    - Design for least common denominator
    - USB PHY on PandaBoard
Practical Considerations

- Hardware
- Software
Practical Considerations

- Hardware
- Software
  - Cross/Native Compile
Practical Considerations

- Hardware
- Software
  - Cross/Native Compile
  - PinMuxing
    - Device Tree Overlays (Pantelis Antoniou)
Practical Considerations

- **Hardware**
- **Software**
  - Cross/Native Compile
  - PinMuxing
    - Device Tree Overlays (Pantelis Antoniou)
    - ACPI with SSDT (Rafael Wysocki)
Practical Considerations

- Hardware
- Software
  - Cross/Native Compile
  - PinMuxing
    - Device Tree Overlays (Pantelis Antoniou)
    - ACPI with SSDT (Rafael Wysocki)
    - ACPI on ARM (Graeme Gregory)
Practical Considerations

- Hardware
- Software
  - Cross/Native Compile
  - PinMuxing
  - Mainline Linux Support
Practical Considerations

- Hardware
- Software
  - Cross/Native Compile
  - PinMuxing
  - Mainline Linux Support
    - Evil Vendor Trees
    - Distribution Selection
Conclusion

- Historical Perspective
- Generals Pros/Cons
- Practical Considerations
Conclusion

- Historical Perspective
- Generals Pros/Cons
- Practical Considerations
- Use the Arch that makes the most sense
Conclusion

- Historical Perspective
- Generals Pros/Cons
- Practical Considerations
- Use the Arch that makes the most sense
- ARM and x86 have a common enemy
Conclusion

- Historical Perspective
- Generals Pros/Cons
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- Use the Arch that makes the most sense
- ARM and x86 have a common enemy

SYSTEMD
Questions?

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