# Compression:
# Can it prevent energy loss?

A study by the MIT Artificial Intelligence Lab

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# Platform

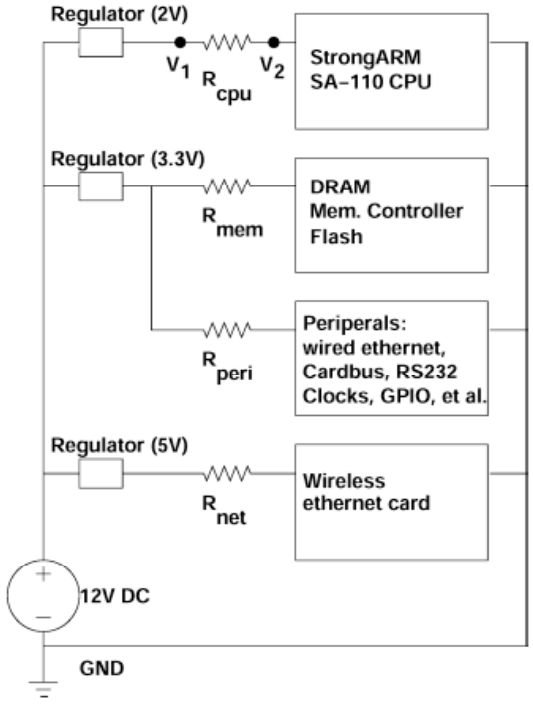
## StrongARM SA-11 skiff

*Developed by Compaq.*

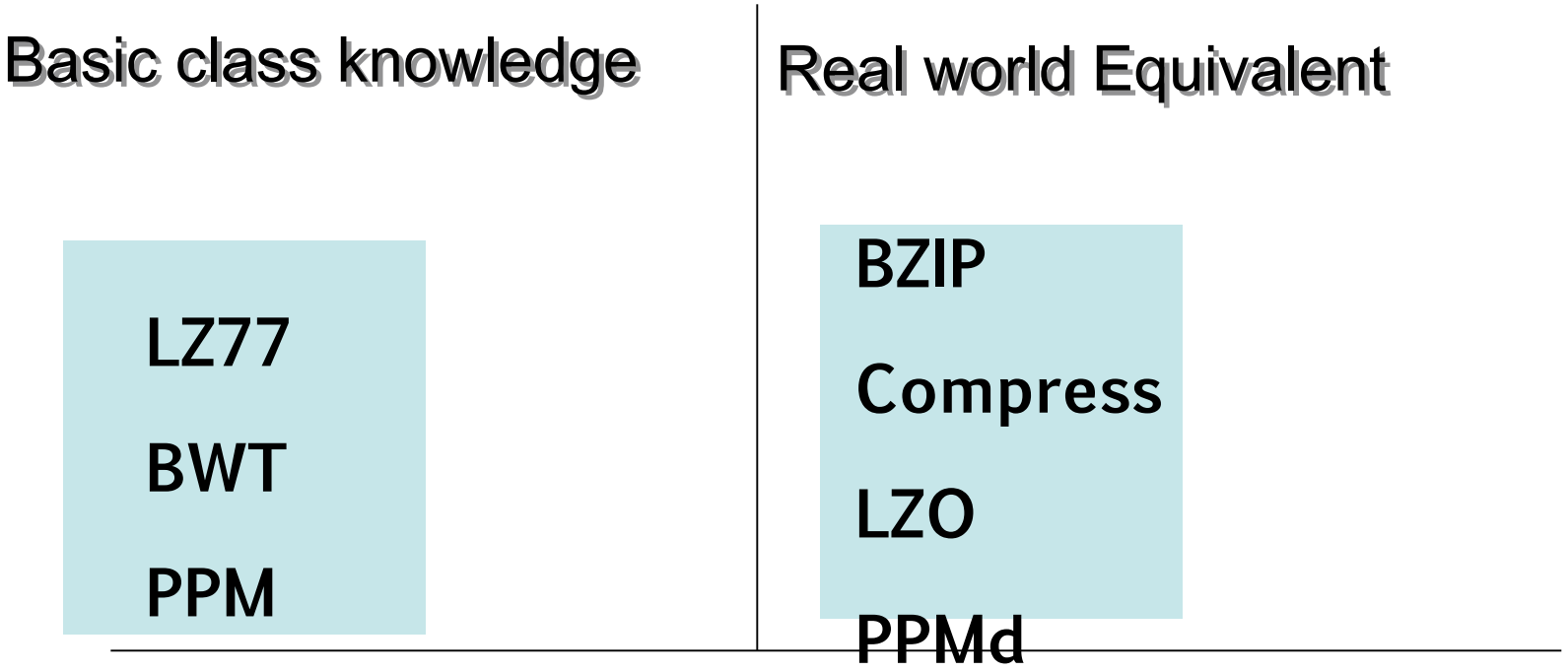
- 233MHZ Processor
- 802.11b card
- 32mb DRAM
- ARM/Linux 2.42-rmk1-np1-hh2
- 4mb Flash memory
- NFS filesystem

Similar to popular Compaq IPAQ

### Schematics



# Compression Methods Tested:




Why were these methods chosen as theoretical test beds?

# Compression Comparison

**How do the native Unix methods compare to each other?**

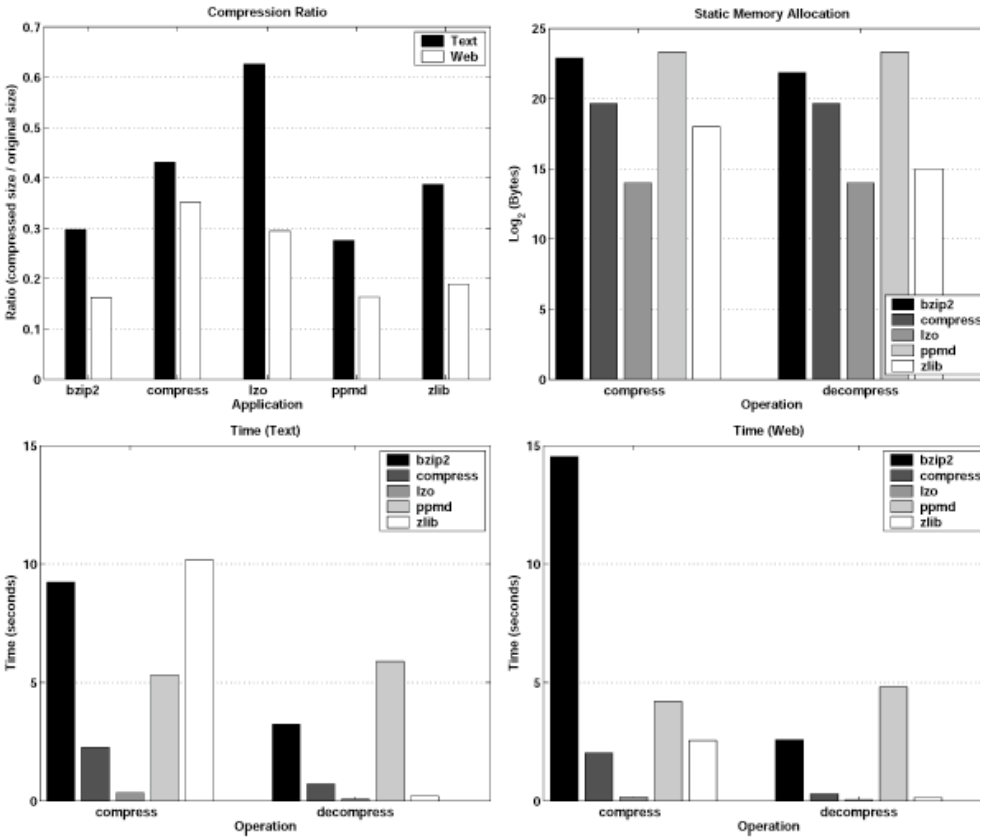



Fig. 3. Benchmark comparison by traditional metrics.

| | bzip2 | compress | LZO | PPMd | zlib |
|---|---|---|---|---|---|
| Compress read throughput (Text data) | 0.91 | 3.70 | 24.22 | 1.57 | 0.82 |
| Decompress write throughput (Text data) | 2.59 | 11.65 | 109.44 | 1.42 | 41.15 |
| Compress read throughput (Web data) | 0.58 | 4.15 | 50.05 | 2.00 | 3.29 |
| Decompress write throughput (Web data) | 3.25 | 27.43 | 150.70 | 1.75 | 61.29 |

# Experiment

*The experiment:*

Basic Overview:

- Simulation
  - Event model
- Purpose of Skiff
  - Power measurement
- Removal of user front end
  - Only kernel threads left
- Corpus
  - Text
  - Web content
  - Differences/similarities
- Automation
  - Simple Scalar
  - Random result sampling
- Error?

**Basic Power Equations**

P=

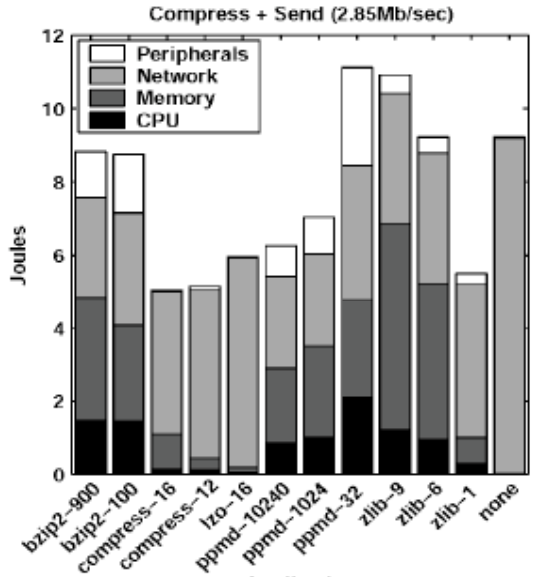
Table II. Maximum Measurement Error: Compression

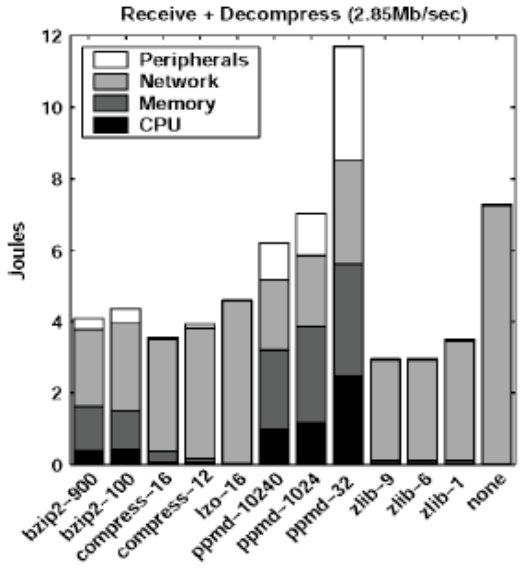
| | CPU (percent) | Memory (percent) | Peripheral (percent) |
|---|---|---|---|
| bzip2 | 0.36 | 0.10 | 0.11 |
| compress | 0.31 | 0.09 | 0.06 |
| lzo | 0.15 | 0.09 | 0.06 |
| PPMd | 0.18 | 0.09 | 0.07 |
| zlib | 0.60 | 0.09 | 0.12 |

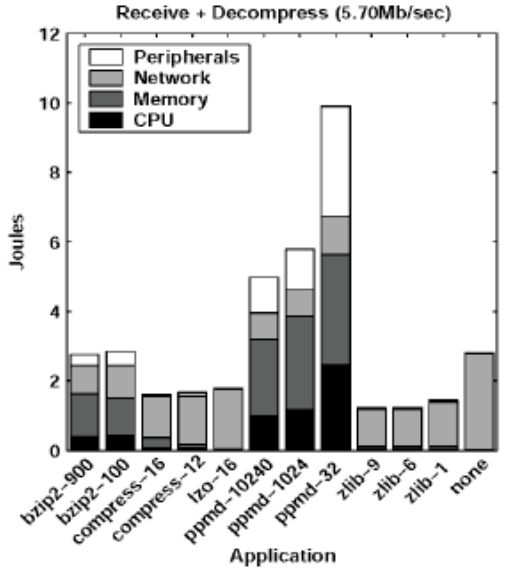
Table III. Maximum Measurement Error: Decompression

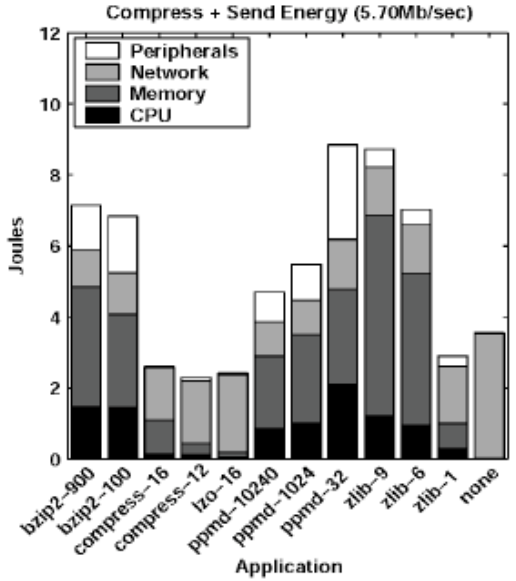
| | CPU (percent) | Memory (percent) | Peripheral (percent) |
|---|---|---|---|
| bzip2 | 0.53 | 0.10 | 0.13 |
| compress | 0.28 | 0.09 | 0.08 |
| lzo | 0.13 | 0.09 | 0.06 |
| PPMd | 0.19 | 0.10 | 0.08 |
| zlib | 0.12 | 0.10 | 0.06 |

# Power use ratio



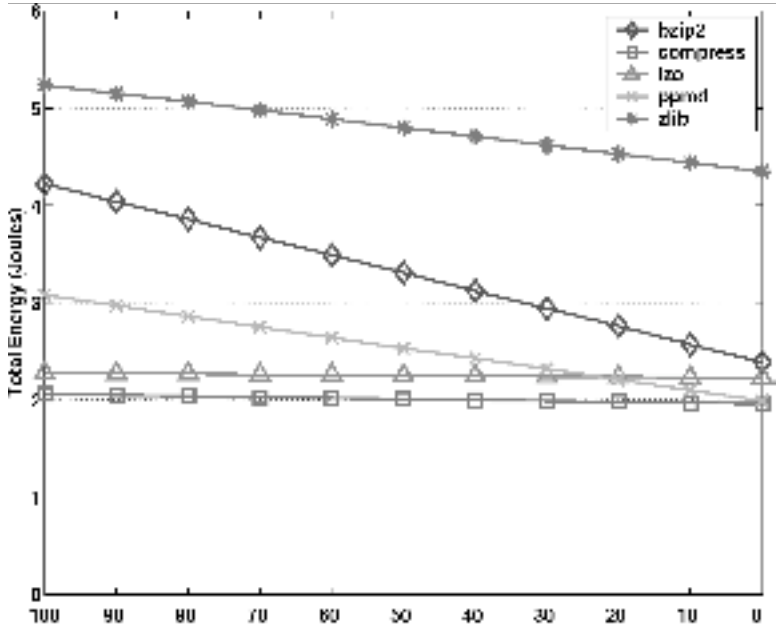



# Energy Efficiency

Ranking

| Compress | Decompress |
|---|---|
| lzo | zlib |
| compress | compress |
| none | lzo |
| ppmd | bzip2 |
| zlib | none |
| bzip2 | ppmd |

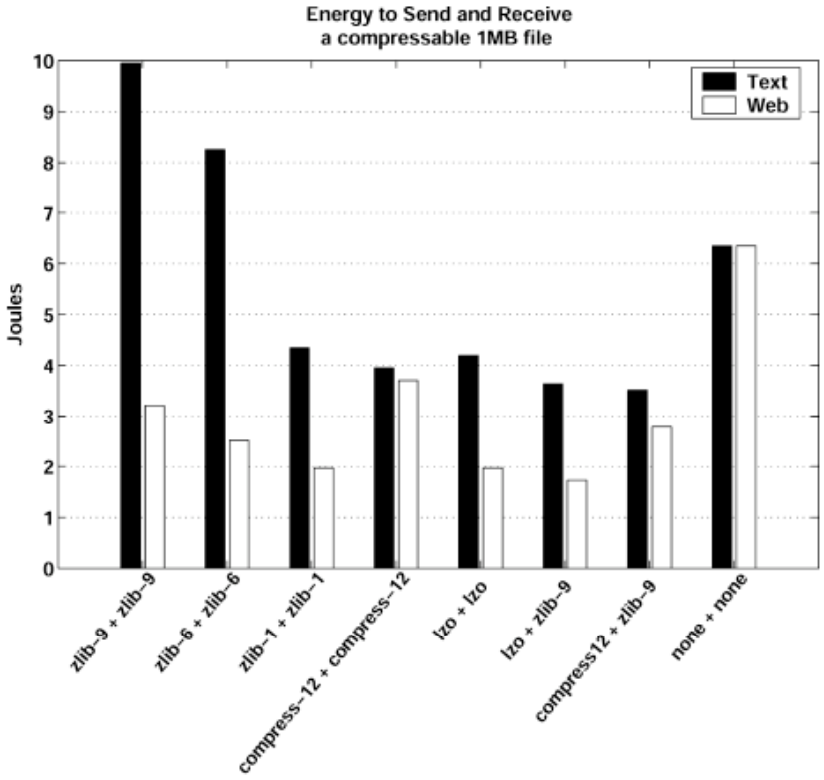
Compression performance even with Power based memory loss



# Example

Potential file content:

- Graphics
- Music
- XML data



# Final Results

## Results Are Close

Given previously discussed room for error, what is the conclusion of the experiment?

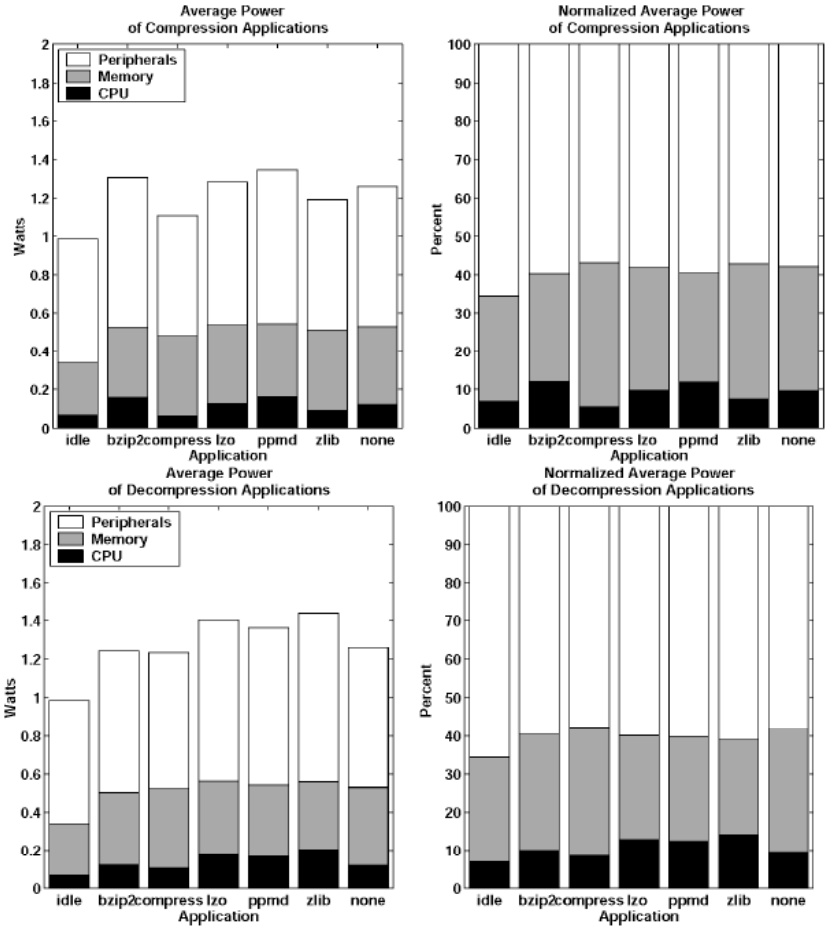



Fig. 12. Average power of compression and decompression applications.