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The Design and Performance of a Bare PC Webmail Server

- Motivation
- Related Work
- Computing Paradigm
- Benefits/Drawbacks
- Design
- Implementation
- Performance
- Conclusions
- Questions/Comments

Motivation

- Obsolescence
- Wastage
- Rapid changes
- Complexity
- Platform dependencies
- No continuity or stability
- No user controllability
- No longevity
- Security Exposures



the hardware requirements to run Vista increased 243 percent, as opposed to the 75-percent requirement increase demanded by Windows XP over Windows 2000.

30 million PCs being dumped each year in the US alone." BBC News: PC users ...

Some computer manufacturers would like you to believe that the old hardware and software won't work any more as soon as they have developed something bigger and better and that is how they make their money.

Complexity

- **Complexity is killing IT, say analysts**

Complexity has arisen from evolution, he added. Operating systems, applications and workload types and volumes kept changing. "The requirements that users impose onto these systems also continue to change," Harrick Vin said.

Platform Dependencies

- Windows
- Linux
- Solaris
- AIX
- VM
- MVS
- Java
- Others

Seeking for a place...

Windows	Linux	Bare ?
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Persistent Storage Media



Bare Pervasive Devices



Processor Architecture

C
+
+
/
J
A
V
A

L
A
N
G

Related Work

- MIT's Exokernel
- OSKit
- SecureLinux
- Embedded Libraries
- Bare Metal Linux
- IO-Lite/Flash
- Microkernel, Nano-kernel
- Embedded systems
- GoogleOS
- BIOS based Browser
- Skype on flash drive
- Lean Linux on flash drive
- Disk less computer
- Blue Gene System (IBM and Lawrence Livermore Lab)
- Palacio and Kitten (Sandia Labs, Northwestern Univ. and Univ. of New Mexico)
- Factored OS (MIT) – light weight or minimalist kernels
- IBM Libra project based on JVM

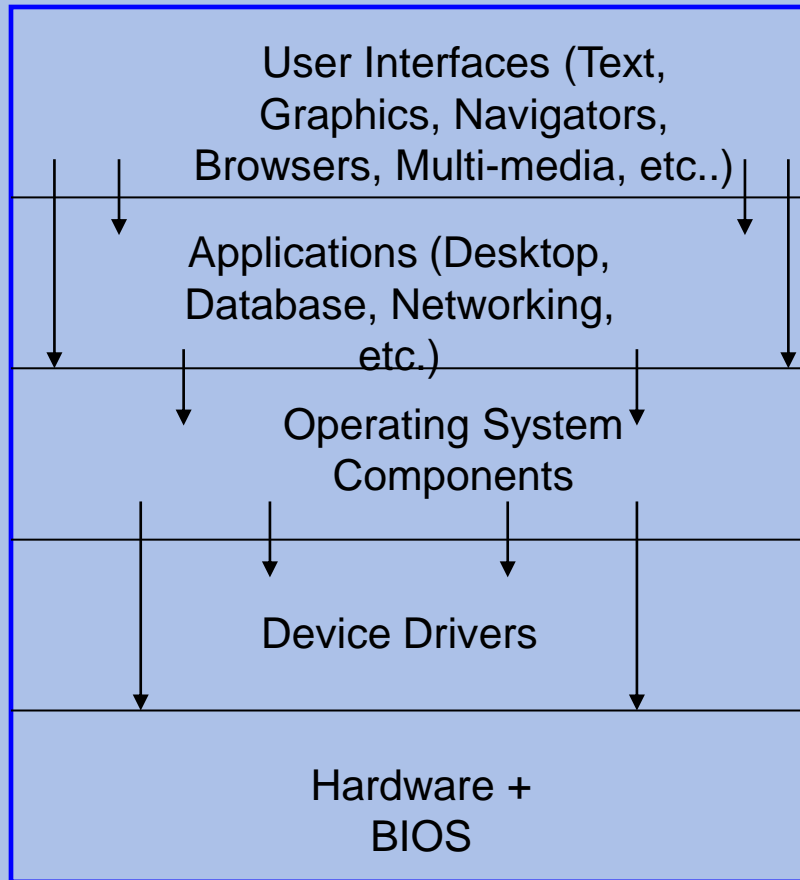
Computing Paradigm

- Concept
- Architecture

Concept

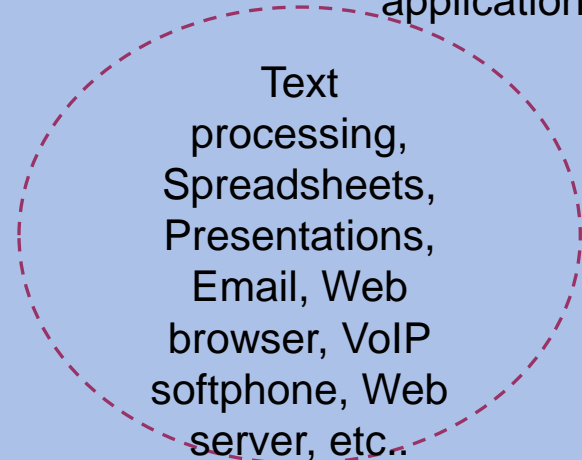


Users



(a) **Conventional Computing**

End user applications



Users

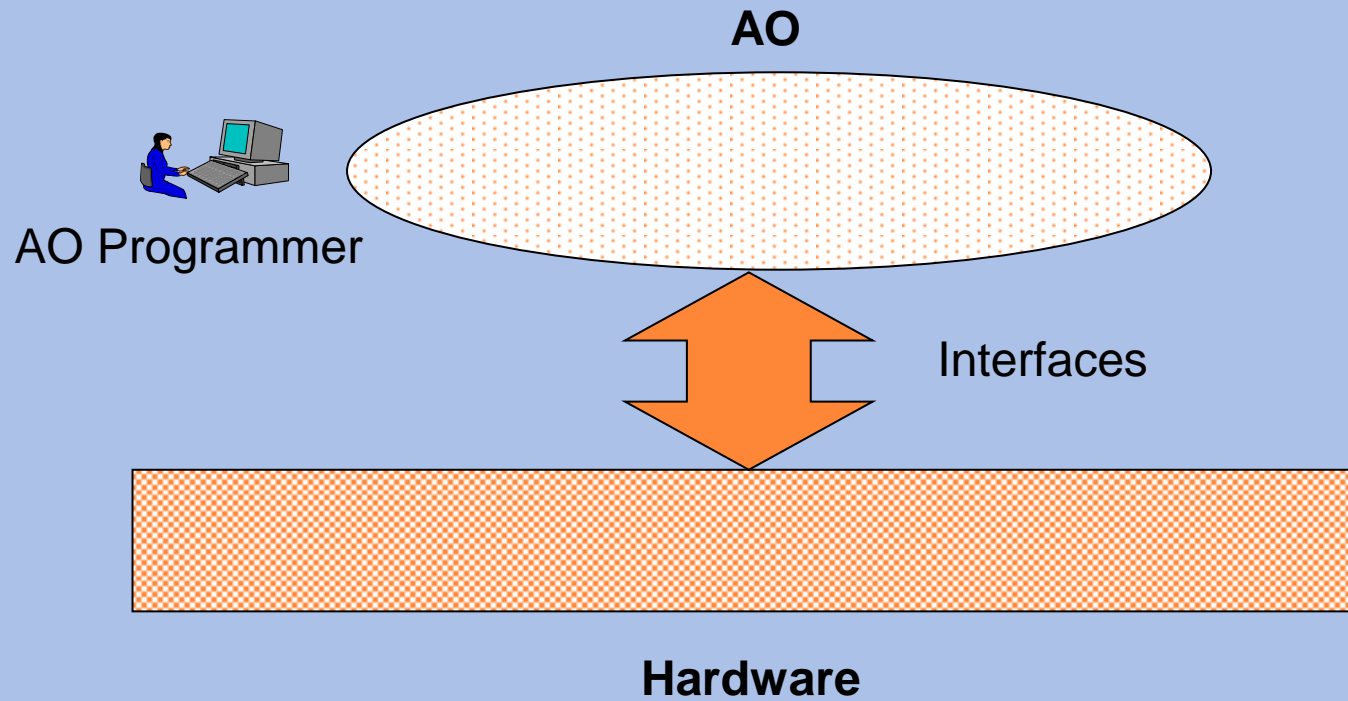


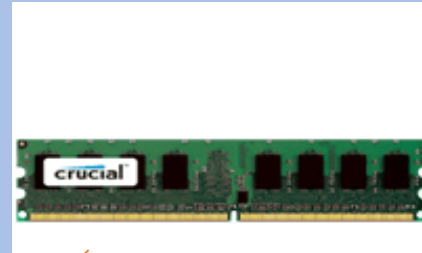
(b) **Bare Machine Computing**

Computing Paradigms

Architecture

- Bare Machine Hardware
- Application Object (AO)

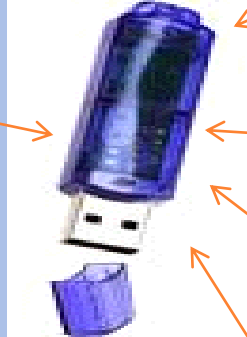




AO

C/C++

Owner

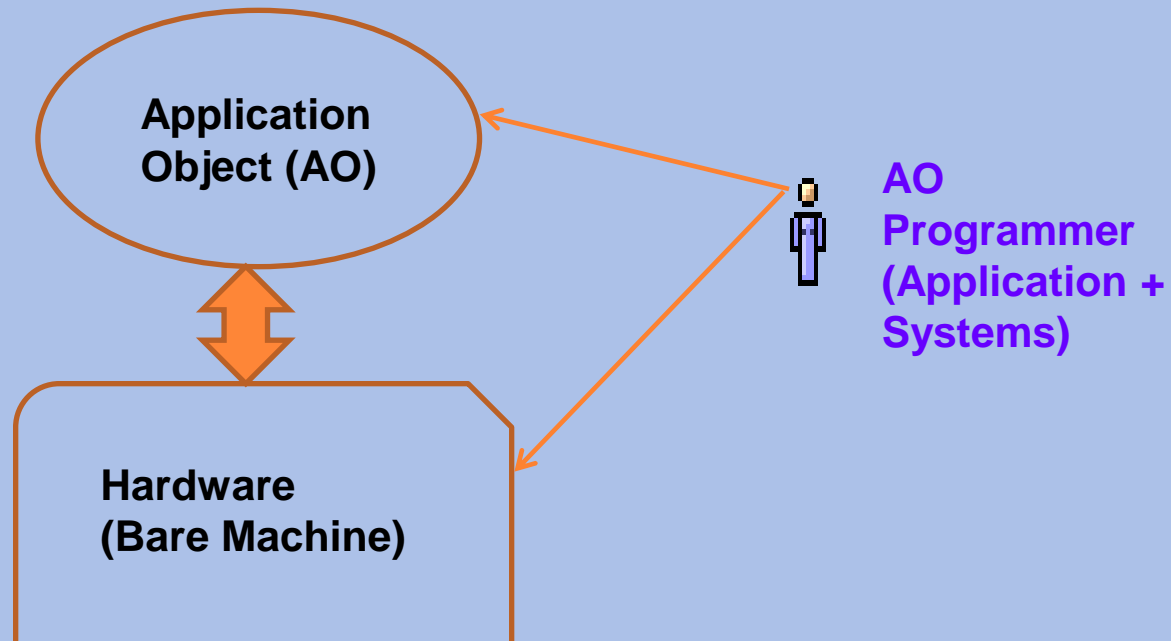
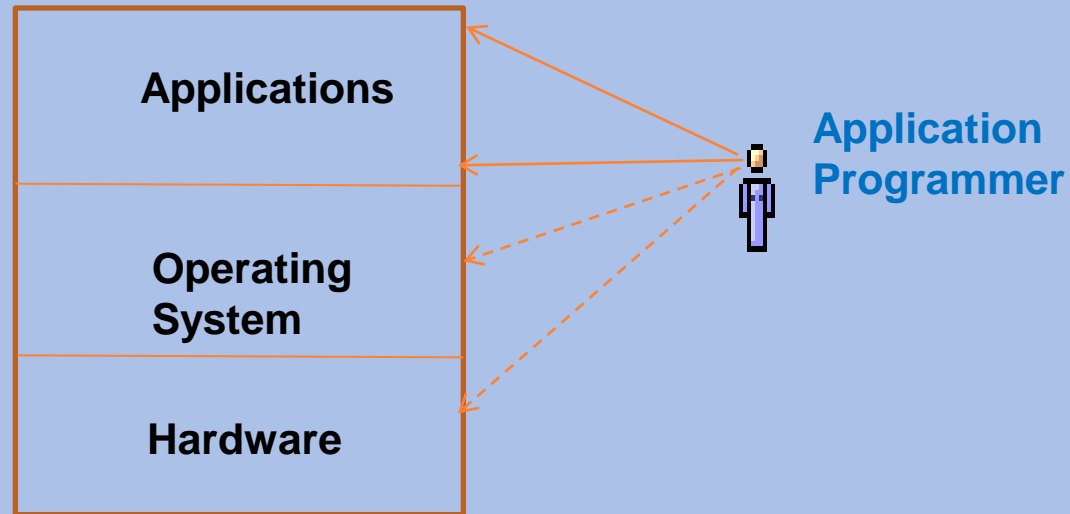


Boot

Loader

Application

Security



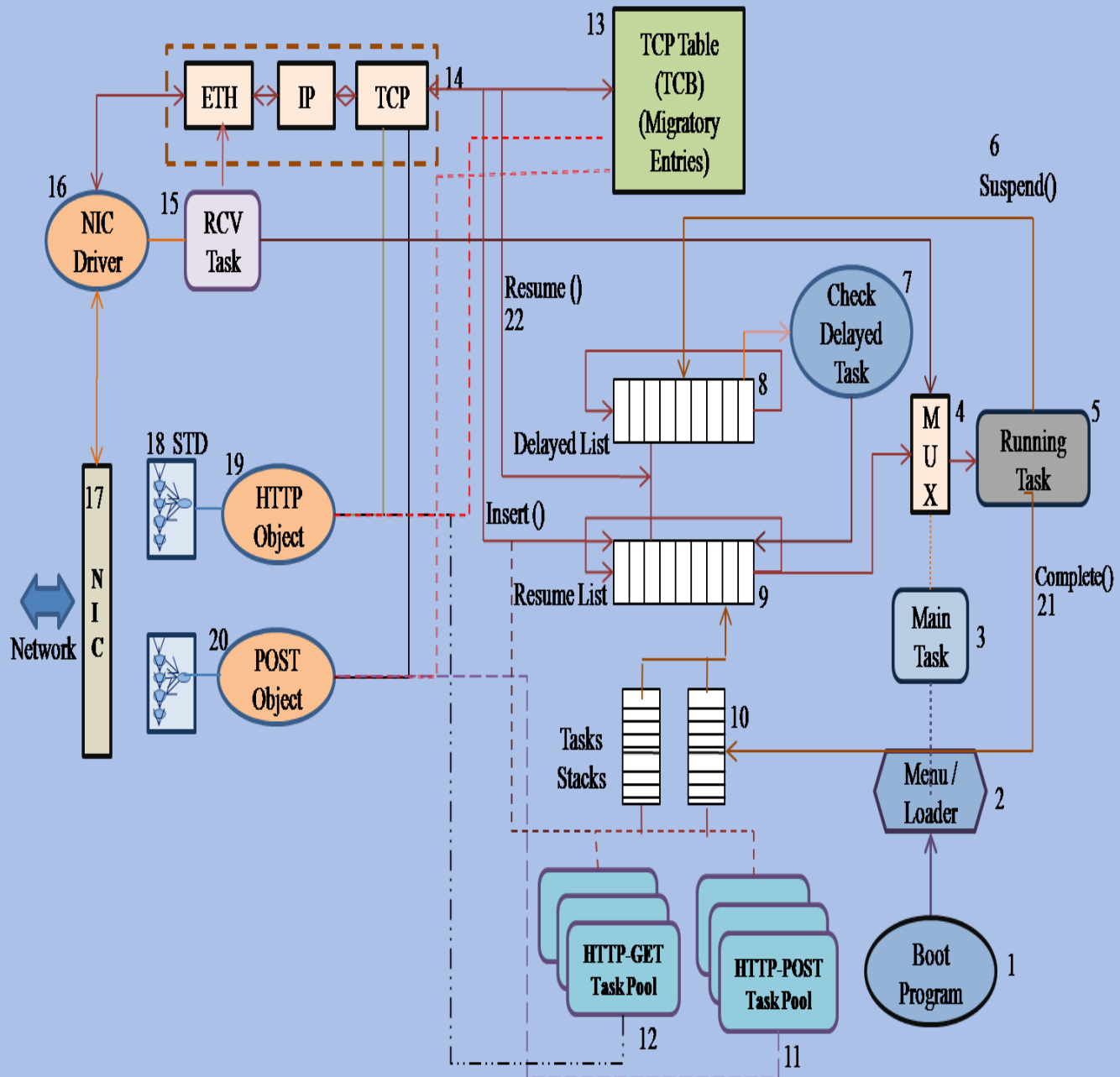
Benefits/Drawbacks

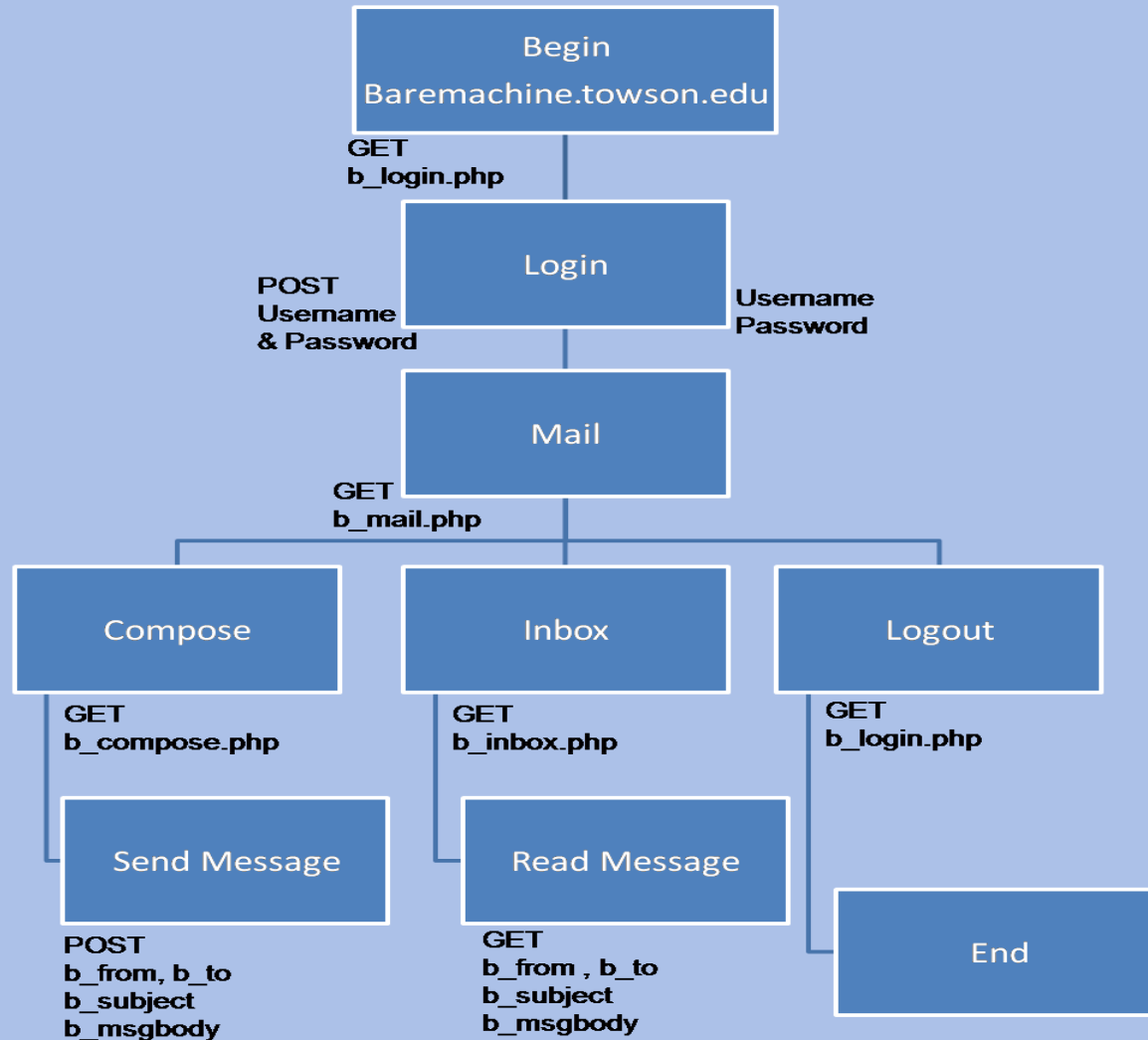
- Benefits
 - Small code size
 - End-user application-centric
 - End-user controlled
 - Single entity based/Independent of environments
 - No Layering
 - Extensible and scalable
 - Higher performance and reliability
 - Inherently secure
 - Design by obscurity
 - Design for Green Computing
 - Design for Longevity

- Drawbacks
 - Not evolutionary
 - AO developer needs to be application as well as systems programmer
 - Needs a different mindset in IT
 - Needs acceptance in IT
 - Seems like a backward approach (it is a myth)

Design

- Client interfaces driven by Webmail server
- Simple interface to client
- Simple email, attachments, distribution list, read emails, and send emails
- Lean PHP parser
- Lean HTTP parser
- Indexing and keyword search used in the parser
- Intertwining protocols
- Dual design to support Web server and Webmail server
- Design based on Email server and extended to Webmail server
- Minimal functionality





Client-Server interface design

Bare Machine WebMail

[Home](#)

Username:

Password:

Login

Bare Machine WebMail

Inbox



Compose



Logout

This is a Bare WebMail System which runs on a Bare PC (i.e. PC without an operating system). It is part of a big research work (Bare Machine Computing). It can send and retrieve emails.

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Bare Machine WebMail

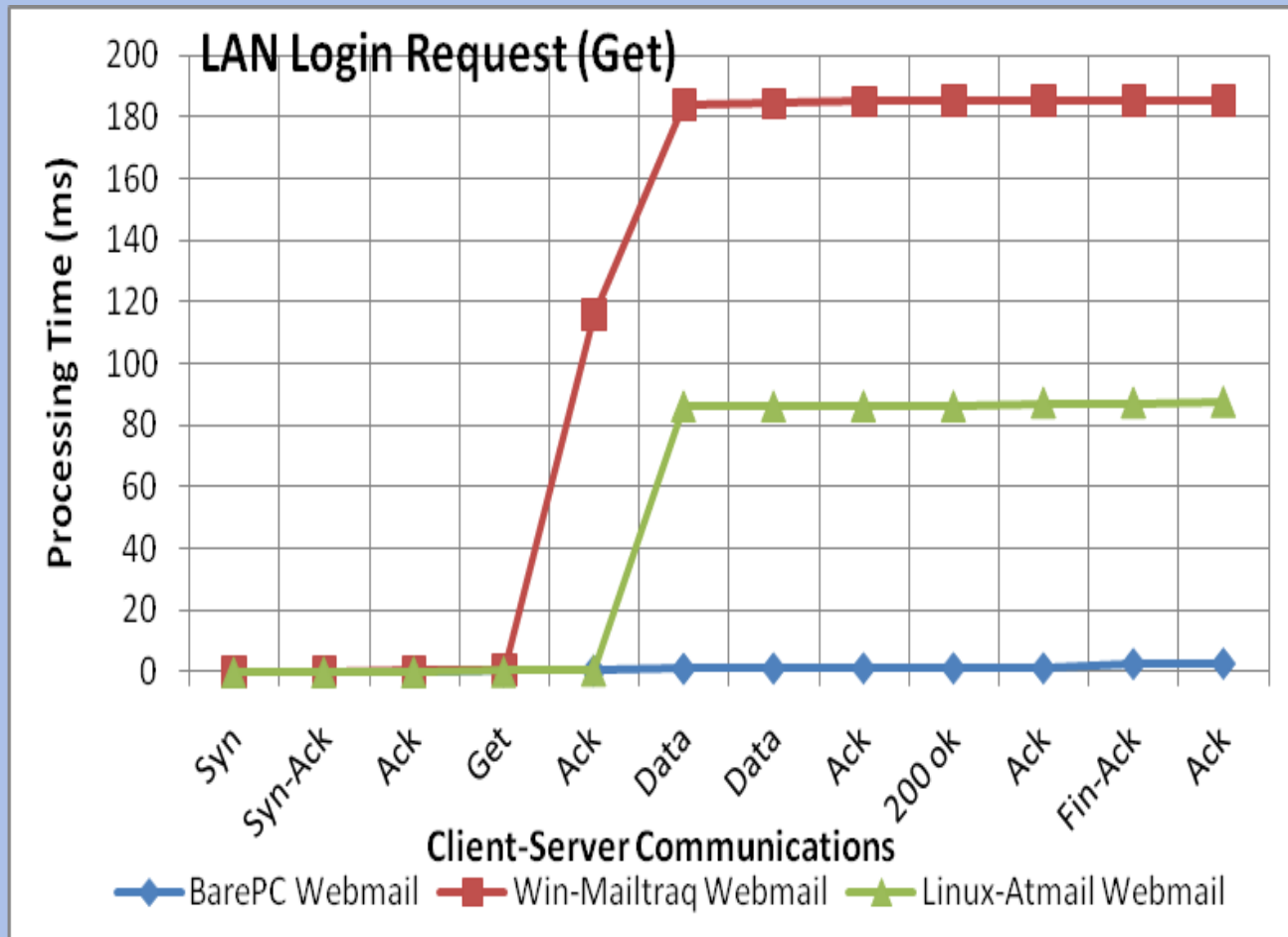
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No.	From	Subject	Date
1	bpc0001@baremachine.towson.edu	info	20100416

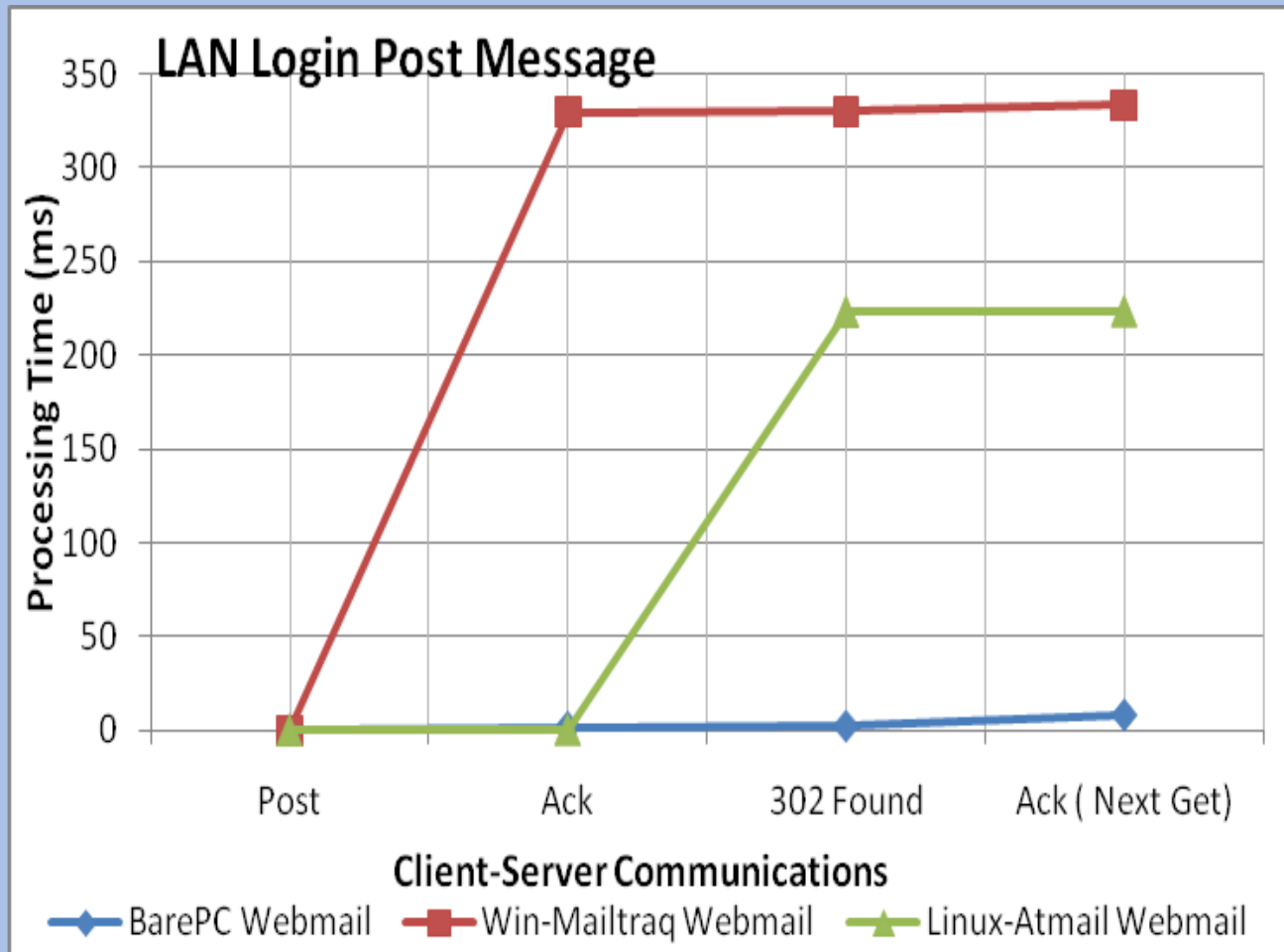
Implementation

- Visual C++
- MASM Assembler
- Display
- Keyboard
- USB Mass Storage
- Timers
- Task Management
- 3COM 905CX NIC Card
- Real/protected mode switching and a Menu interface

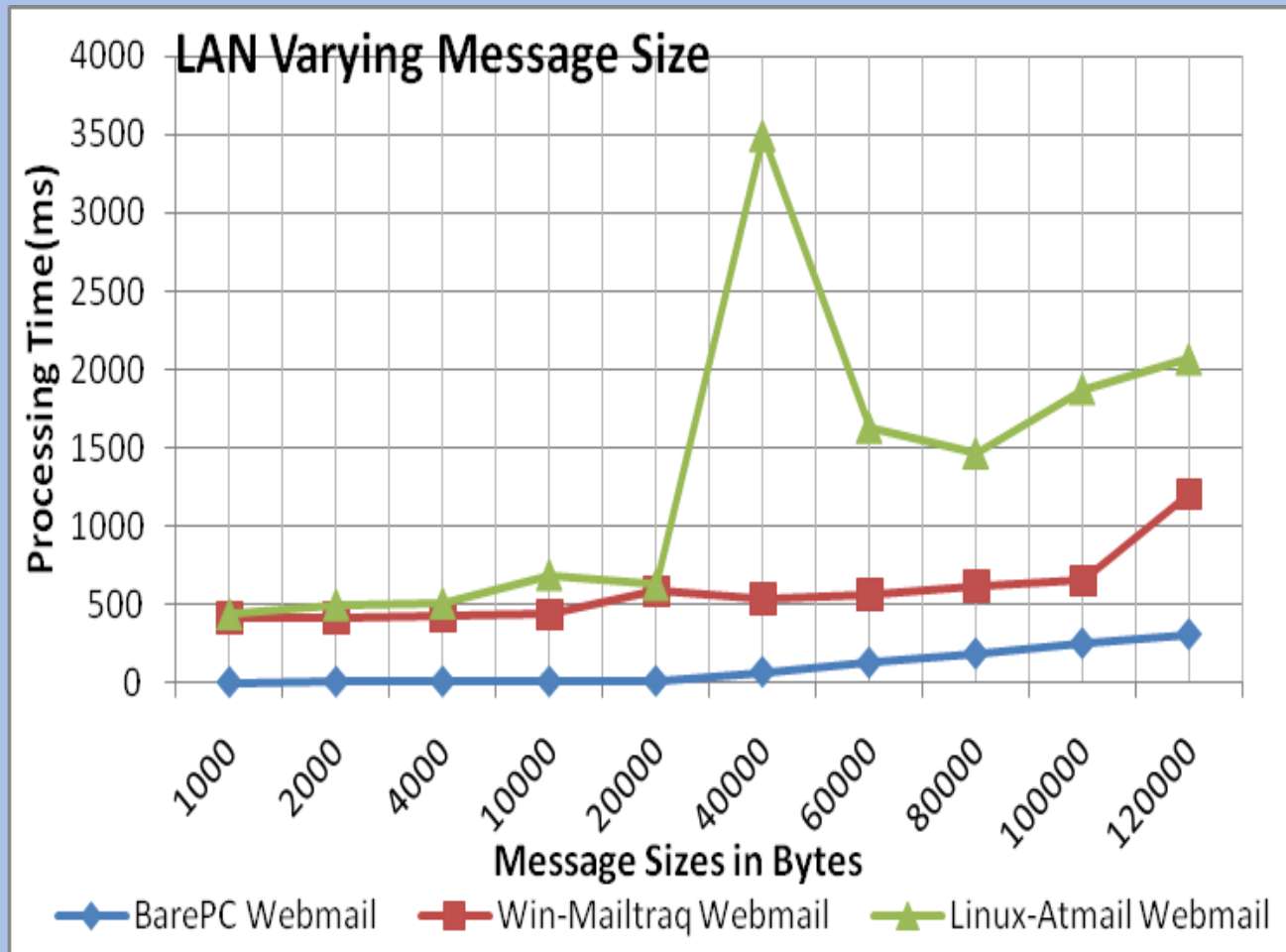
Performance



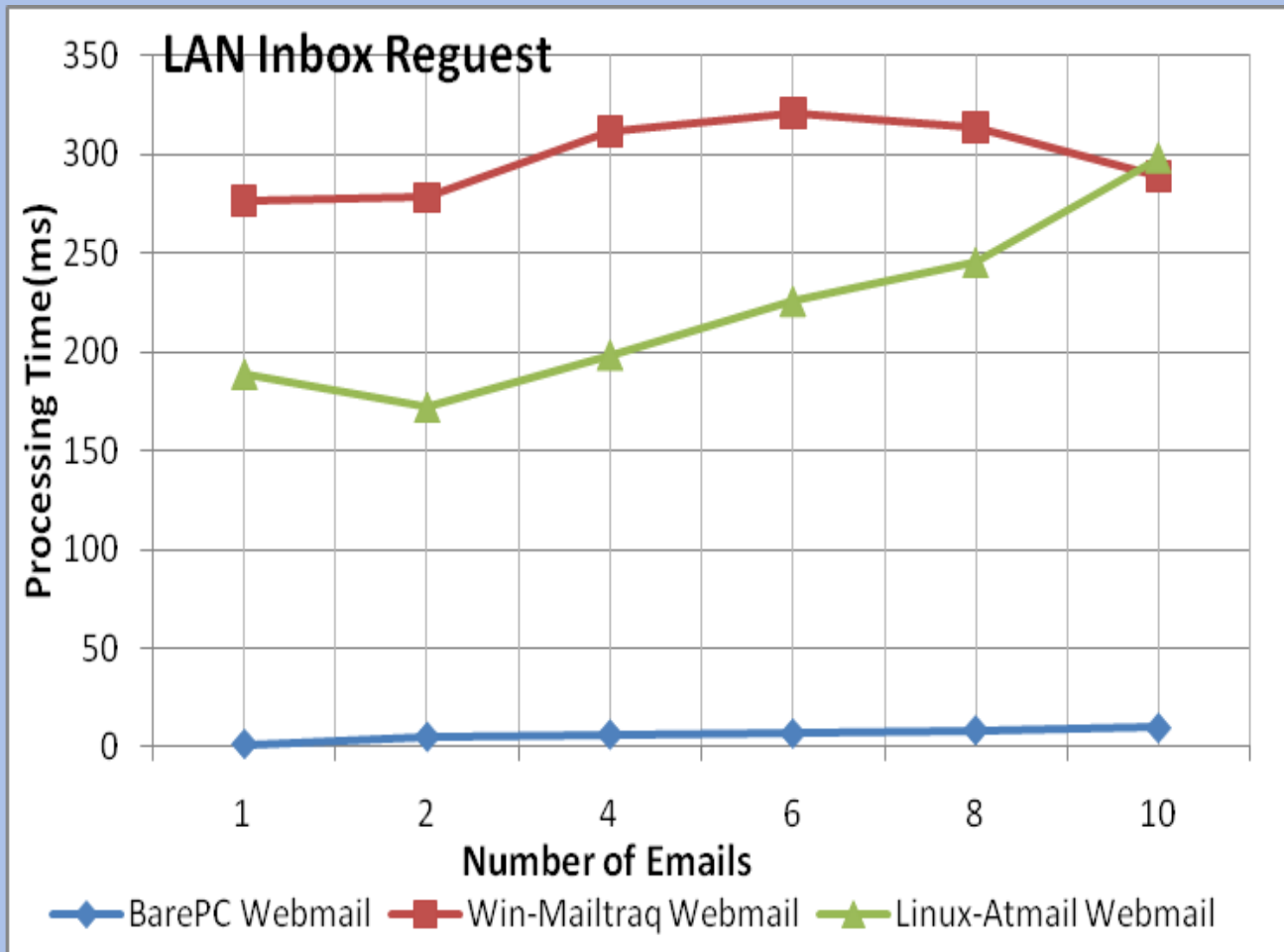
Processing time: login request (GET)



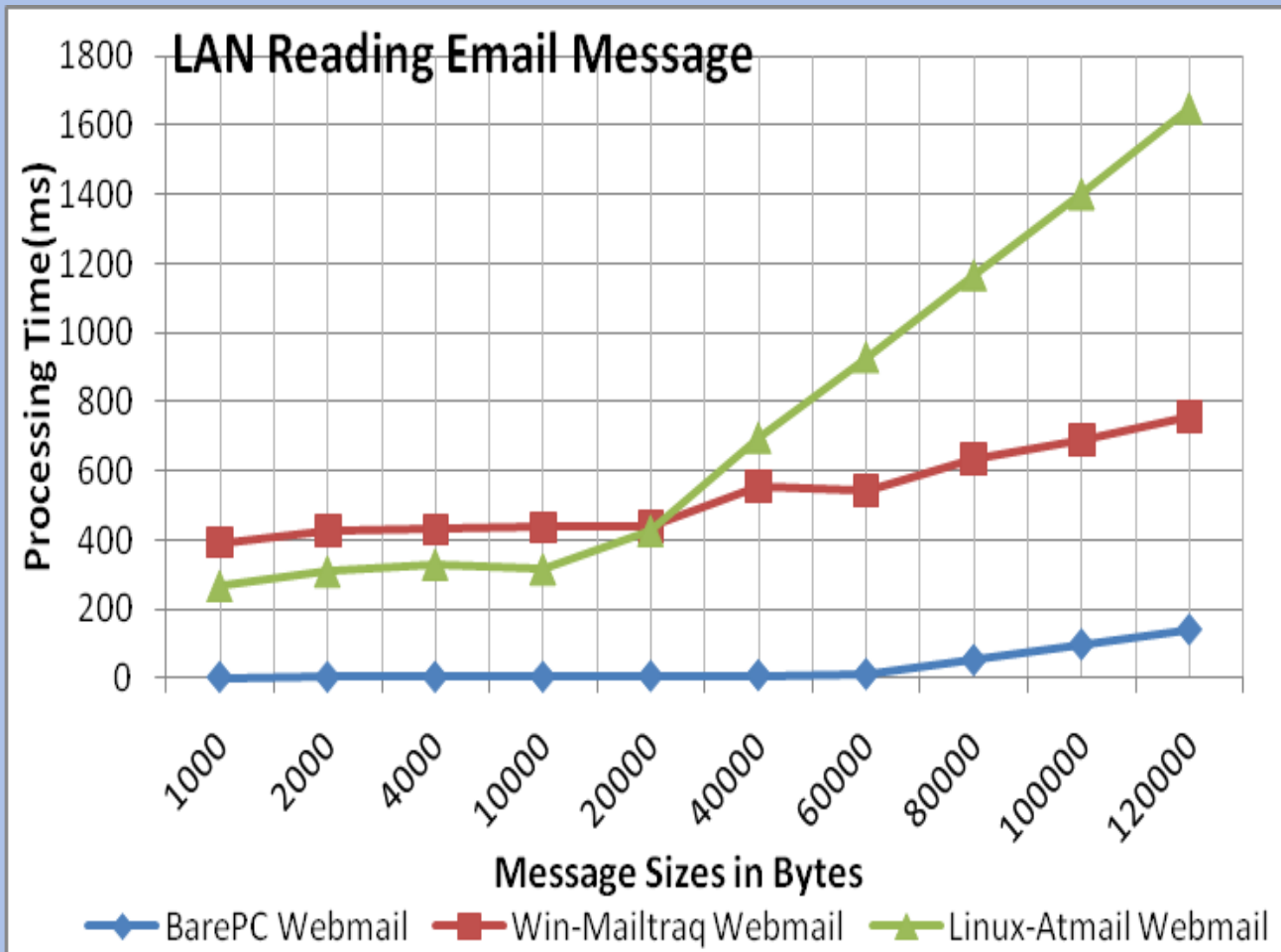
Processing time: login request (POST)



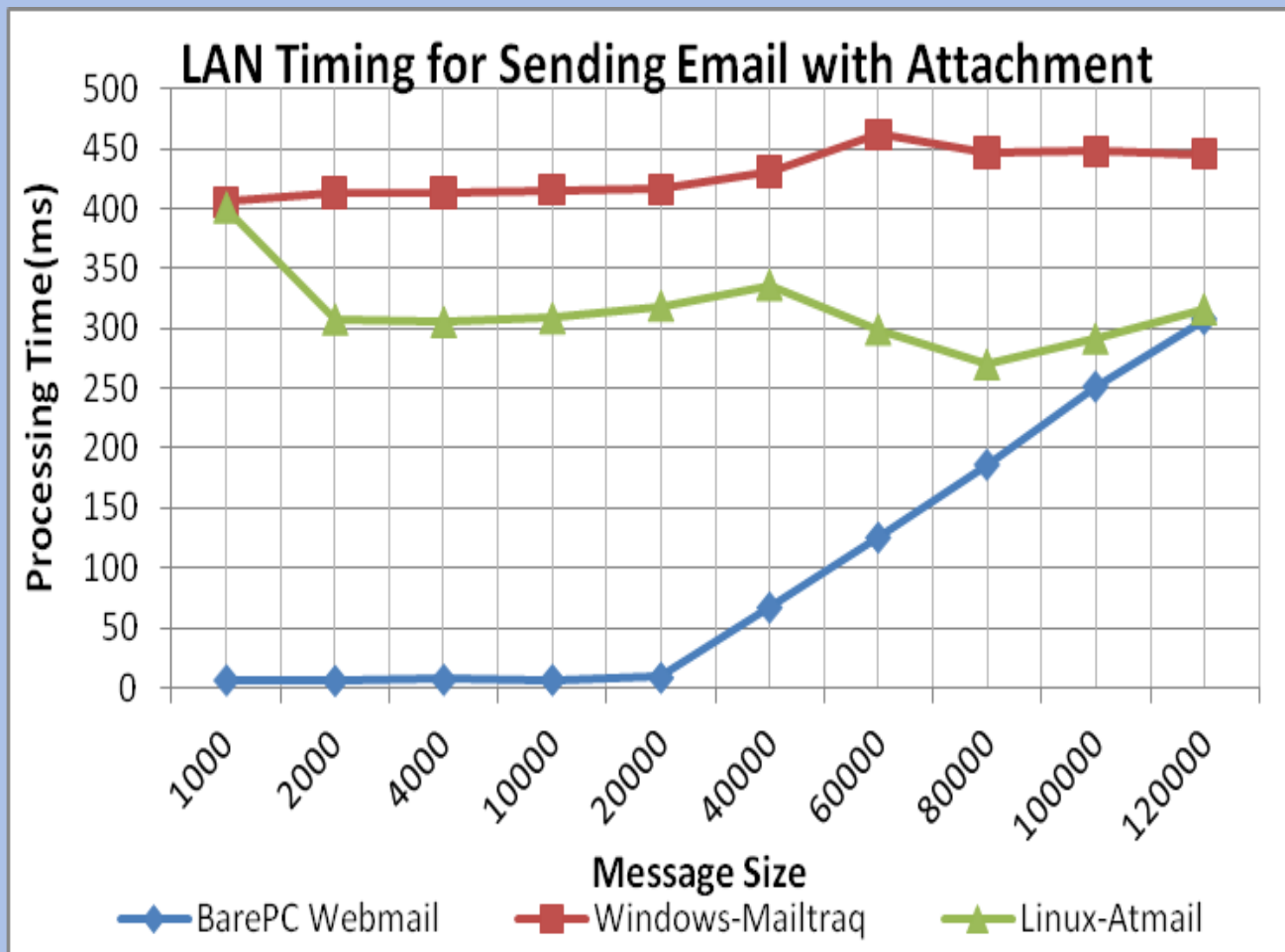
Processing time: compose (varying message sizes)



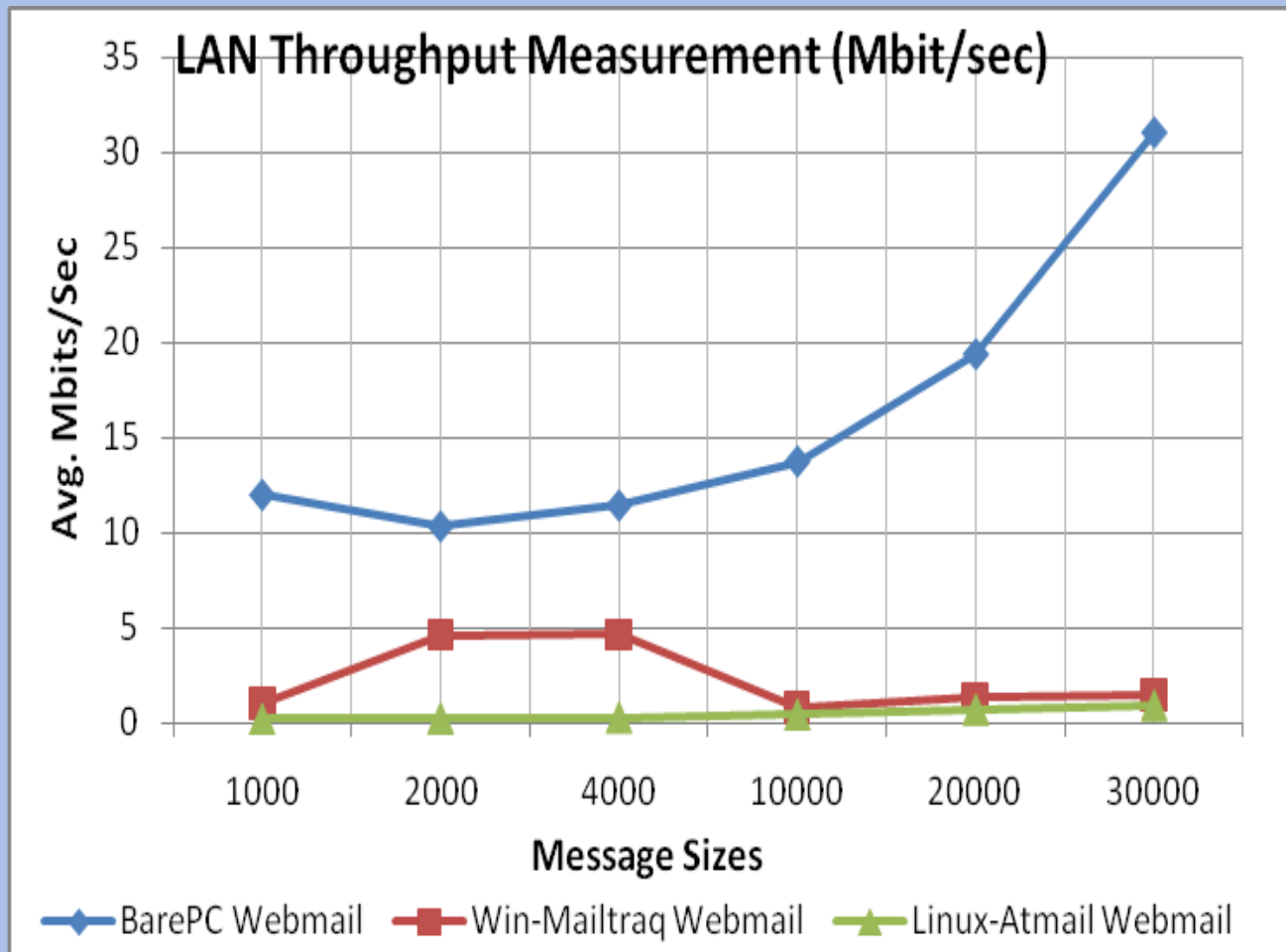
Processing time: inbox request (varying number of emails)



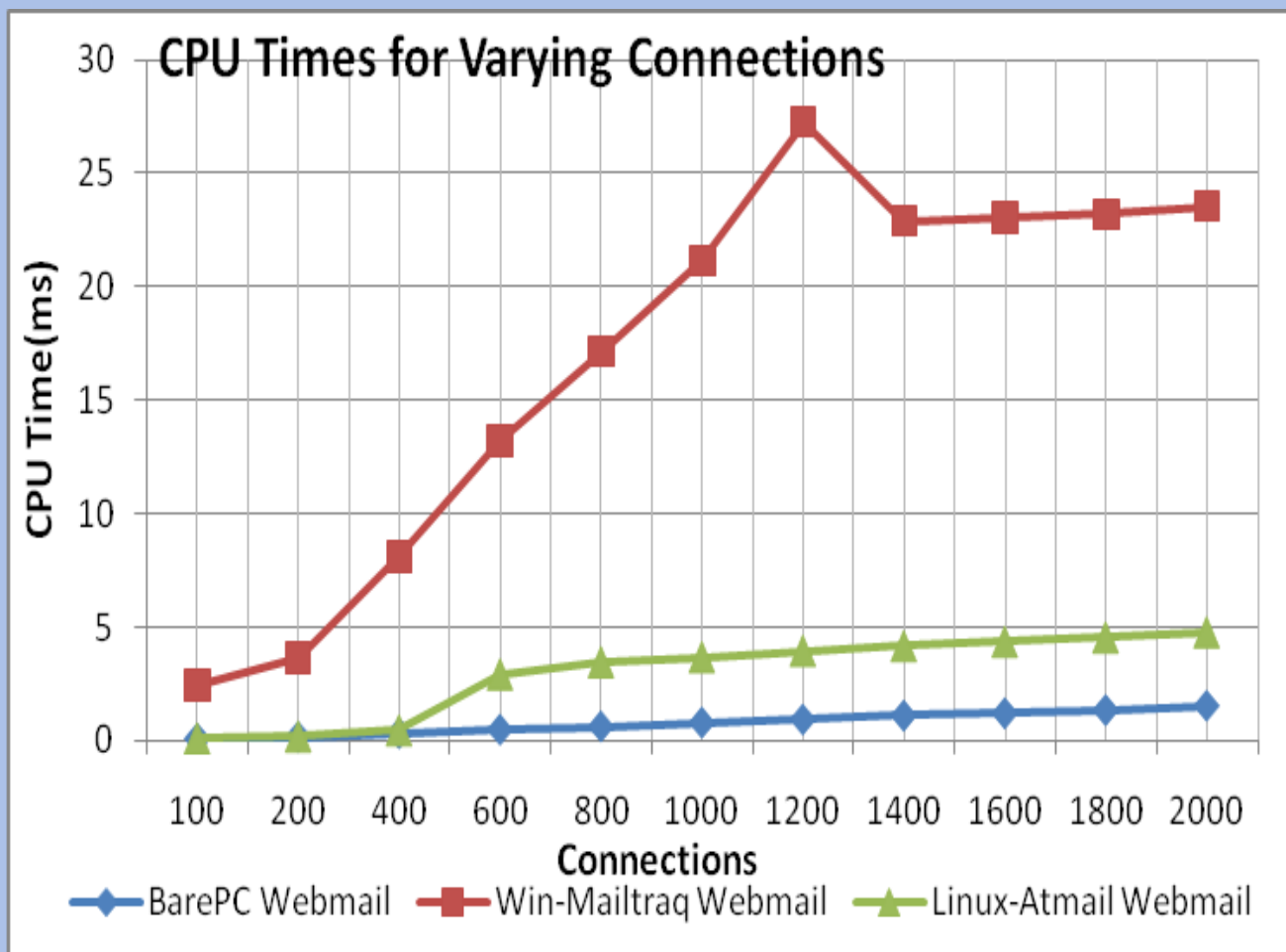
Processing time: email retrieval (varying message size)



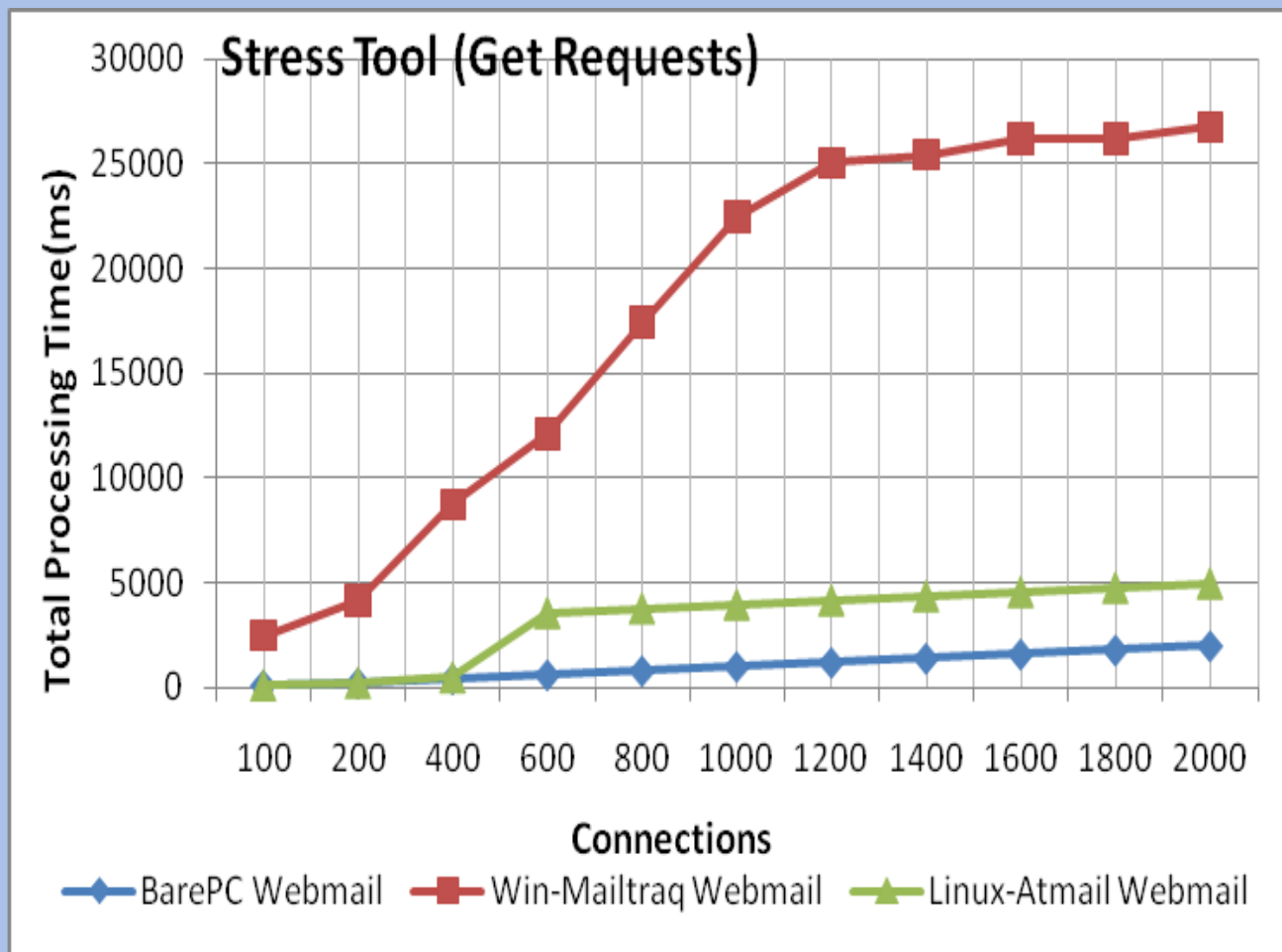
Processing time: email attachment (varying message size)



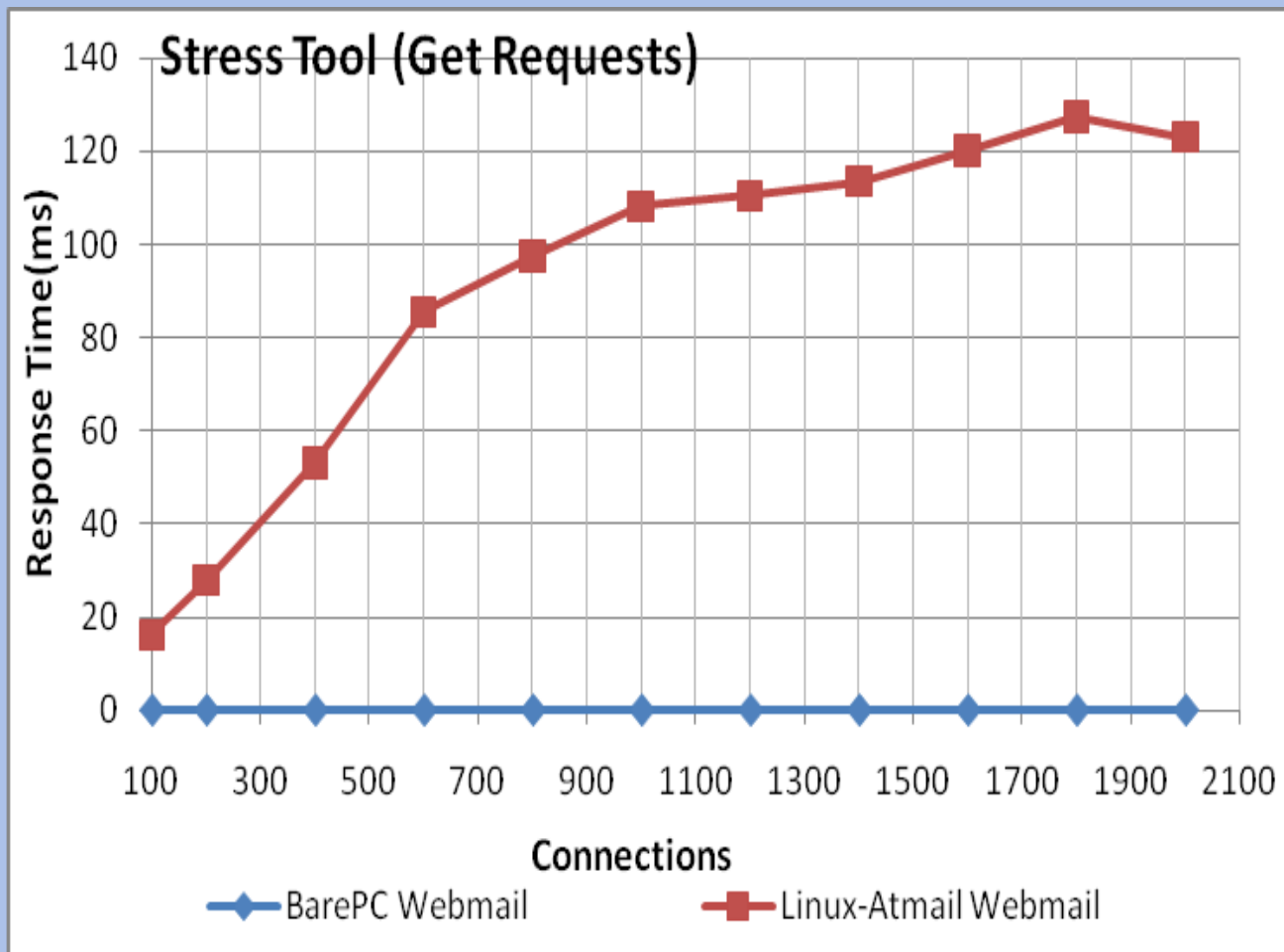
Throughput



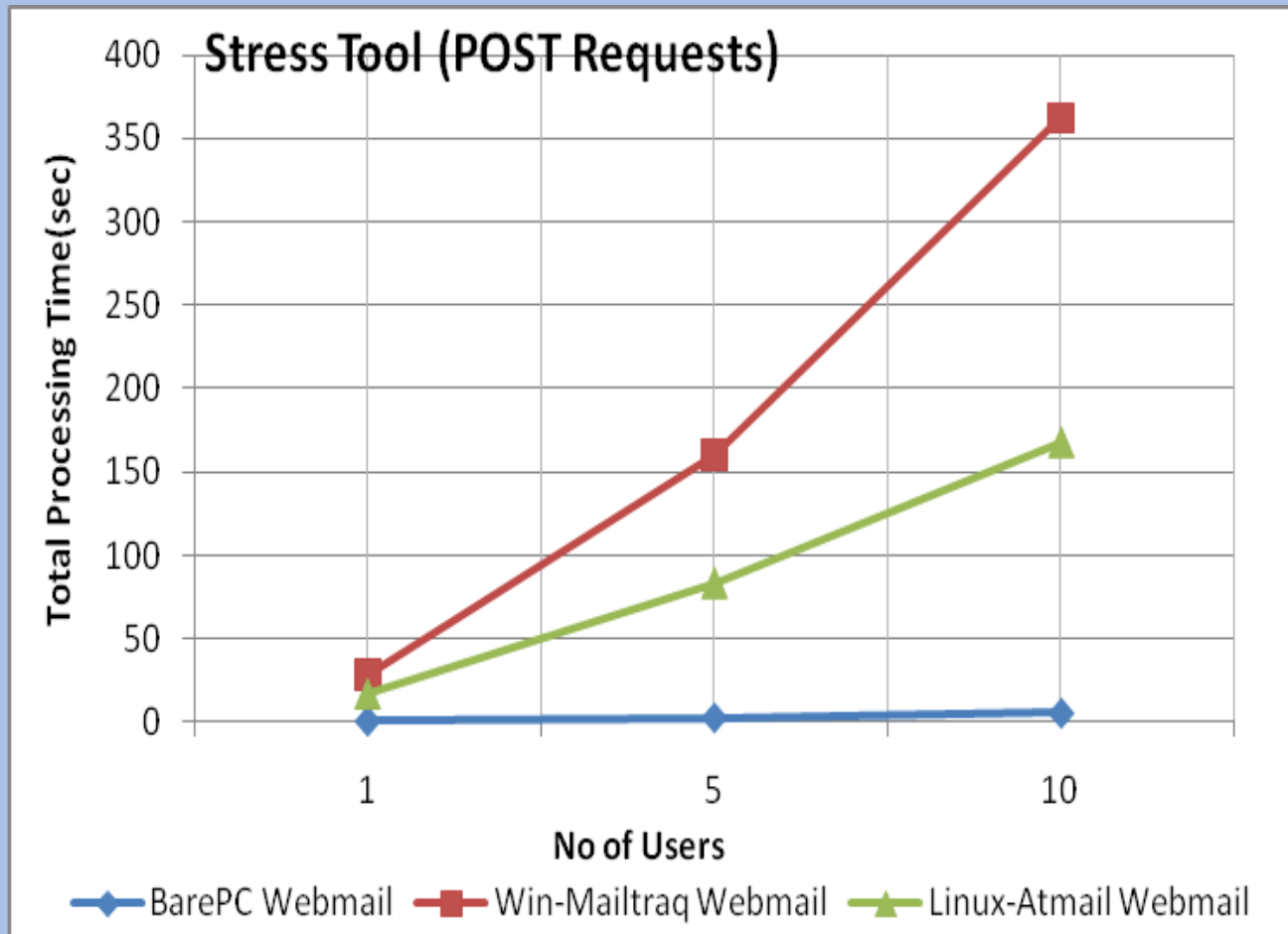
CPU processing time: client (varying number of connections)



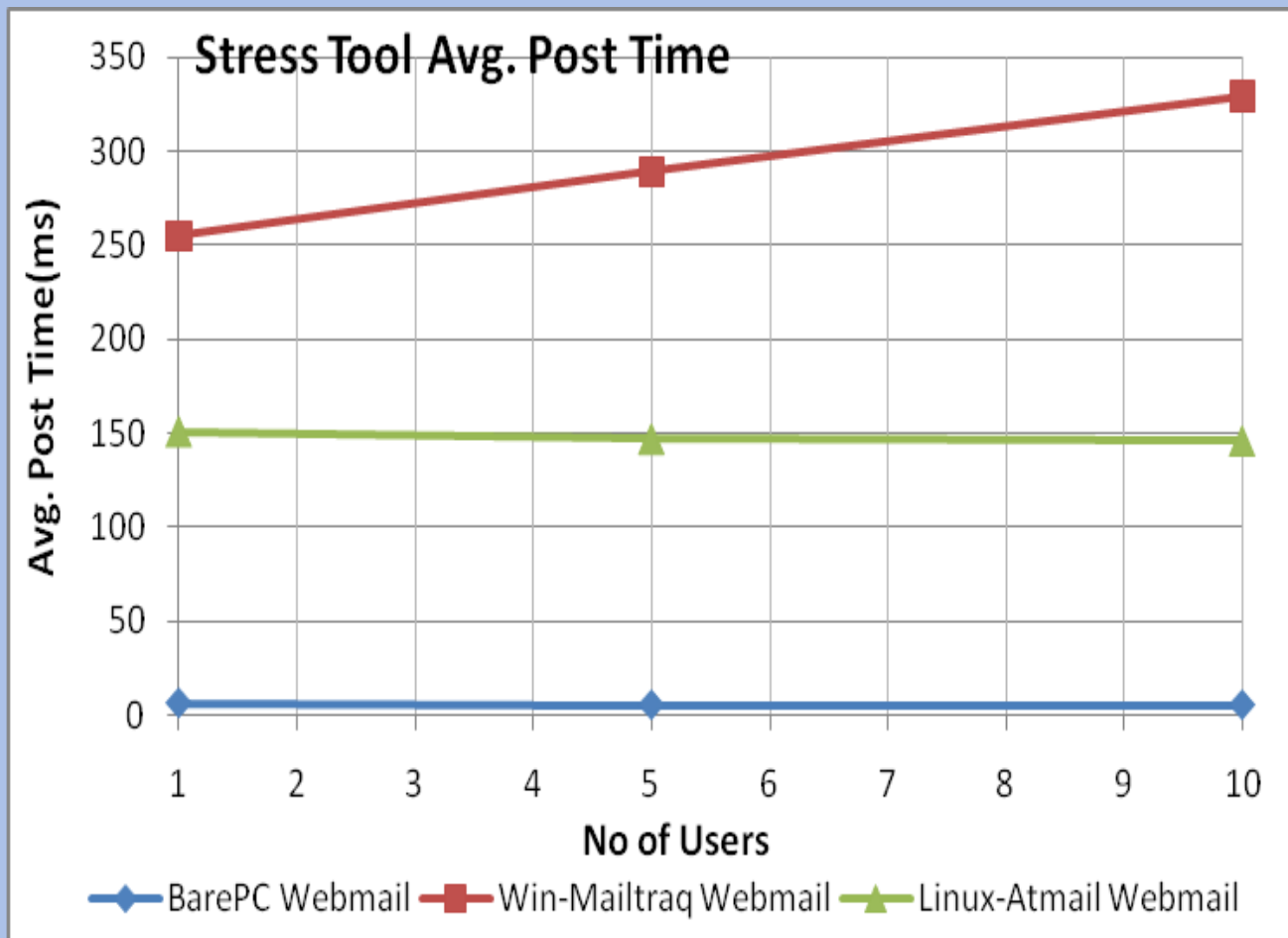
Processing time: GET (varying number of connections)



Response time: GET (varying number of connections)



Total processing time: POST (varying number of users)



Average processing time: POST (varying number of users)

Conclusions

- The server architecture and design is based on the BMC approach.
 - No OS required
 - Single Application Object
- Design based on Email server and Web server
- Experiments conducted on dedicated LAN environment
- Experiment results show that bare PC Webmail server outperforms conventional Webmail servers in all performance attributes
- Webmail server can be used for small group of users
- Needs security enhancements

Questions/Comments

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