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**BAHIRDAR INSTITUTE OF TECHNOLOGY(BiT)**

**FACULTY OF COMPUTING**

**DEPARTMENT OF INFORMATION TECHNOLOGY (Bed)**

**OS PROJECT ASSIGNMENT**

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**Year :3<sup>rd</sup> year**

Allocated OS:Smart os

Allocated Mobile Brand:Acer

Allocated PC brand:CLEVO

## OPERATING SYSTEM PROJECT(SMART OS)

### Introduction

SmartOS is an open-source datacenter virtualization platform developed by Joyent. It combines the Illumos kernel, ZFS filesystem, Zones (lightweight containers), and KVM virtualization into a single operating system. Unlike traditional OS installations, SmartOS is designed to run entirely from memory, making it lightweight, secure, and highly efficient for cloud and virtualization workloads. The motivation for this project is to gain hands-on experience with virtualization technologies and understand how SmartOS integrates advanced features like ZFS and Zones for modern computing environments.

Smart OS is a modern, lightweight operating system designed for efficiency, security, and performance. It is commonly used in virtualized environments and cloud-based systems. Smart OS supports advanced features such as virtualization, fast booting, and resource management, making it suitable for both learning and enterprise environments. This project focuses on understanding Smart OS installation, features, and basic operations in a virtual environment.

### Background & History of SmartOS

#### 1. Origins

- SmartOS is a descendant of Illumos, which itself is a fork of OpenSolaris.
- After Oracle discontinued OpenSolaris in 2010, the Illumos project was created to keep the Solaris kernel and userland alive as open-source.
- SmartOS was created by Joyent in 2011 as a hypervisor-focused Illumos distribution.

#### 2. Purpose & Design Philosophy

- Built for cloud and virtualization from the ground up.
- Combines three key technologies:

- ZFS (advanced filesystem)
- DTrace (dynamic tracing)
- Zones (lightweight OS-level virtualization)
- Designed to be minimal, stateless, and run entirely from RAM/USB — the OS loads into memory at boot.

### 3. Key Historical Milestones

- 2011: First release by Joyent.
- 2013: Introduction of KVM support, allowing Linux/Windows VMs to run alongside Solaris zones.
- 2016: Project became fully community-driven after Joyent open-sourced more components.
- 2020s: Continued development with focus on containerization, hardware support, and cloud-native features.

### 4. Technical Legacy

- Inherits Solaris/UNIX reliability, stability, and networking stack.
- Pioneered hybrid virtualization (Zones + KVM).
- Influenced modern containerization tools (early inspiration for Docker/LXC).

### Why SmartOS is Relevant Today

- Still used in infrastructure, networking, and storage appliances.
- Popular for ZFS-based NAS/SAN solutions.
- Used in research and education for studying OS/ virtualization concepts.
- Lightweight, secure, and excellent for server virtualization.

## Objectives

- Demonstrate the installation of SmartOS in a virtual environment.
- Understand SmartOS architecture (Illumos + ZFS + Zones + KVM).
- Explore filesystem support and virtualization concepts.
- Develop troubleshooting skills during installation.
- Prepare for real-world system administration tasks involving SmartOS

## Requirements

### Hardware

- **CPU:**
  - Must be a **64-bit x86 processor** (Intel or AMD).
  - Minimum: **4 cores** to handle virtualization workloads.
  - Recommended: **8 cores or more** for running multiple zones/VMs simultaneously.
  - Features: Support for **hardware virtualization extensions** (Intel VT-x or AMD-V).
- **RAM:**
  - Minimum: **4 GB** (enough for basic SmartOS boot and a few lightweight zones).
  - Recommended: **16 GB or more** for stable performance with ZFS and multiple VMs.
  - Note: SmartOS runs entirely from RAM, so higher memory ensures smoother operation.
- **Storage:**
  - Minimum: **20 GB** (basic installation and small zones).
  - Recommended: **100 GB or more** to fully utilize **ZFS features** (snapshots, clones, compression).
  - Type: Prefer **SSD** for faster I/O and better ZFS performance.
  - Interface: SATA or NVMe supported.
- **Network:**
  - At least **1x Gigabit Ethernet adapter**.
  - Recommended: Multiple NICs for advanced networking setups (bridging, VLANs, isolated VM networks).
  - Virtualization tools can emulate NICs (Intel PRO/1000, VirtIO).

### Software

- **Virtualization Tool:**
  - VMware Workstation (robust hardware compatibility, better performance).
  - Oracle VM VirtualBox (free, widely used, good for learning).

- Ensure the virtualization tool supports **Solaris/Illumos-based OS**.
- **SmartOS ISO Image:**
  - Download from the official site: smartos.org.
  - Latest stable build recommended.
  - SmartOS boots directly from ISO into RAM (no traditional installer).
- **Host Operating System:**
  - Windows, Linux, or macOS (depending on virtualization tool).
  - Ensure host OS has sufficient resources to allocate to the VM.
- **Additional Tools (Optional):**
  - SSH client (e.g., PuTTY, OpenSSH) for remote management.
  - Web browser for accessing SmartOS documentation and community resources.
  - Disk imaging tools if you want to create persistent storage pools.

## Installation Steps (Virtual Machine)

- Download SmartOS ISO from the official site.
- Create a new VM in VirtualBox/VMware:
  - OS type: Other/Illumos (Solaris-based)
  - Allocate CPU cores and RAM (e.g., 4 cores, 8 GB RAM).
  - Attach SmartOS ISO as boot media.
- Boot the VM → SmartOS runs directly from RAM.
- Configure networking (bridge/NAT depending on setup).
- Create zones or virtual machines using SmartOS tools (`vmadm`, `imgadm`).
- Set up user account with your full name as required.

Note: Insert step for each step with captions.

Figure 1: Virtual Machine Home Screen



This step shows the VirtualBox main interface before creating a new virtual machine.

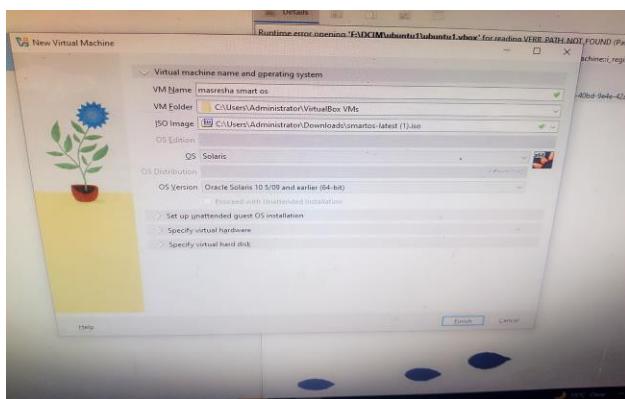
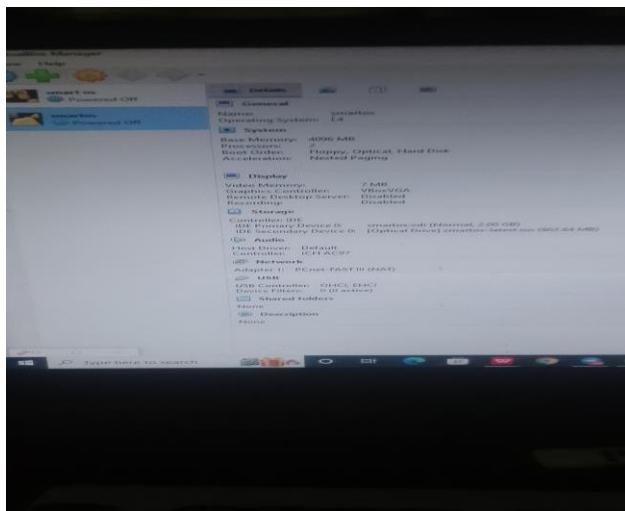


Figure 2: New Virtual Machine Creation



This step shows the creation of a new virtual machine named Smart OS, with OS type set appropriately.

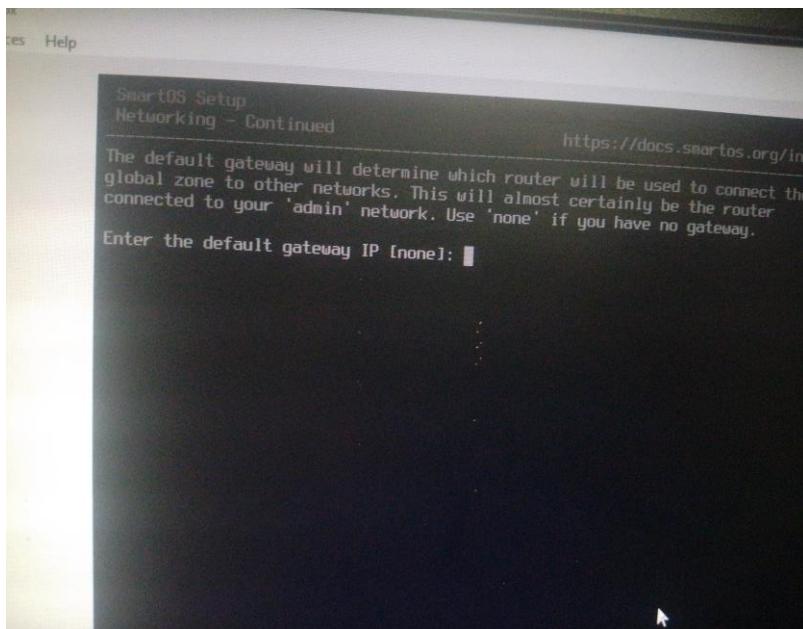
Figure 3: Memory Allocation

This step shows RAM allocation for Smart OS virtual machine.

Figure 4: Virtual Hard Disk Configuration

This step shows disk creation using dynamically allocated storage.

Figure 5: Smart OS Boot Screen



This step shows the initial boot menu of Smart OS.

Figure 6: Installation Process



This steps shows Smart OS installation steps including disk selection and configuration.



## Features of Smart OS

- Lightweight and fast performance
- Strong support for virtualization
- Secure system architecture
- Efficient resource management
- Command-line based management

## Issues Faced During Installation

- Network configuration difficulties
- Limited graphical interface
- Hardware compatibility issues

## **Filesystem Support**

SmartOS primarily uses ZFS as its default filesystem:

- ZFS Advantages: Snapshots, copy-on-write, data integrity, scalability.
- Other supported filesystems: **UFS**, tmpfs (for temporary storage).
- ZFS is chosen because it ensures high reliability and performance in virtualization environments

### **Advantages**

- Lightweight, runs from RAM.
- Advanced virtualization (Zones + KVM).
- Powerful ZFS filesystem.
- High scalability for datacenter workloads.

### **Disadvantages**

- Requires dedicated hardware (not a typical desktop OS).
- Steeper learning curve compared to Linux/Windows.
- Limited desktop applications

## **Virtualization (What, Why, How)**

### **What is Virtualization?**

- ✓ Virtualization is the process of running an operating system on virtual hardware instead of physical hardware.

### **Why Virtualization?**

- ✓ Safe testing environment
- ✓ Cost-effective
- ✓ Multiple OS on one machine

### **How Virtualization Works?**

- ✓ Using hypervisors such as VirtualBox or VMware.

## **Conclusion**

Smart OS is a powerful and efficient operating system designed mainly for virtualized and cloud environments. Installing Smart OS in a virtual machine helps students understand modern operating system concepts such as virtualization, resource management, and system security. This project enhanced practical

knowledge and technical skills. SmartOS is a specialized OS for virtualization and cloud computing, offering unique features like Zones and ZFS. Installing it in a virtual environment provides valuable insights into modern OS design and datacenter management.

## Future Recommendation

- Learn advanced Smart OS commands
- Practice networking and storage management
- Explore cloud-based deployment
- Use Smart OS with container technologies
- Explore **Triton DataCenter**, Joyent's orchestration platform built on SmartOS.
- Compare SmartOS with alternatives like **Proxmox** or **VMware ESXi**.
- Investigate SmartOS's role in **containerization vs. Docker/Kubernetes**.
- Recommend SmartOS for **research labs and enterprise virtualization** projects.