

Week 1

IT601 – System and Network Administration

Prepared by DL...

May You All Stay Success in your Whole Life,
Ameen! Summ Ameen... Just Remember us
in your Deep Prayers. JazakAllah...

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Virtual University of Pakistan

➤ **Computers and networks are now a days a vital part of the daily life.**

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➤ **The need to have specialized people to operate and maintain computers and networks**

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➤ **System administration matters because computers and networks matter**

➤ **This course focuses on the principles of systems and network administration**

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➤ **Following are text and reference books in addition to various articles from internet**

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➤ Credit Hours:

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➤ Assessment

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IT SYSTEM

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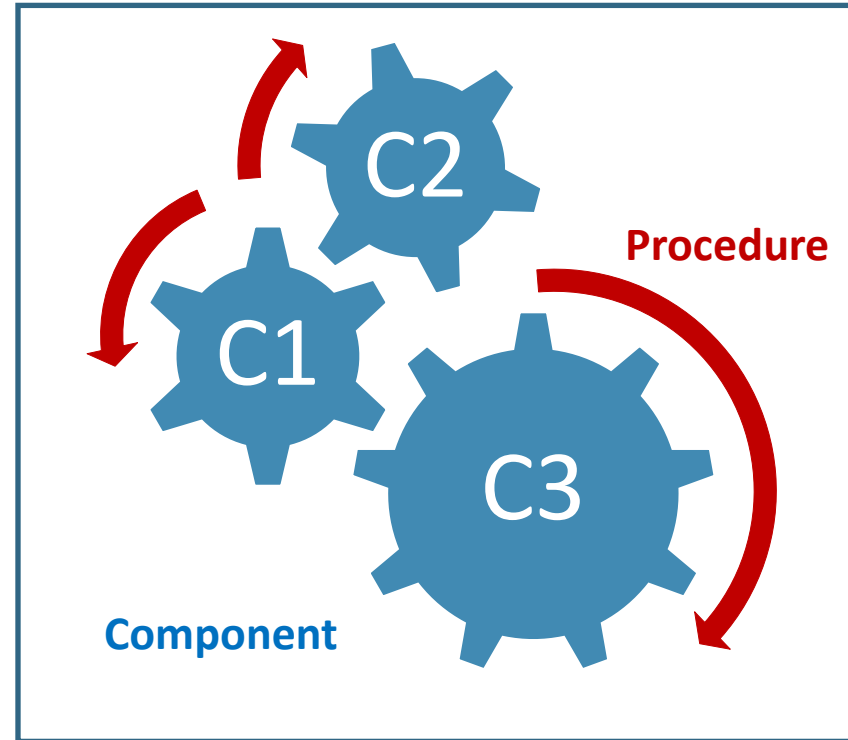
System

- **System**
- **IT System**
- **General Definition**

IT System

A. What is a System?

A system is a collection of elements or components that are organized for a common purpose



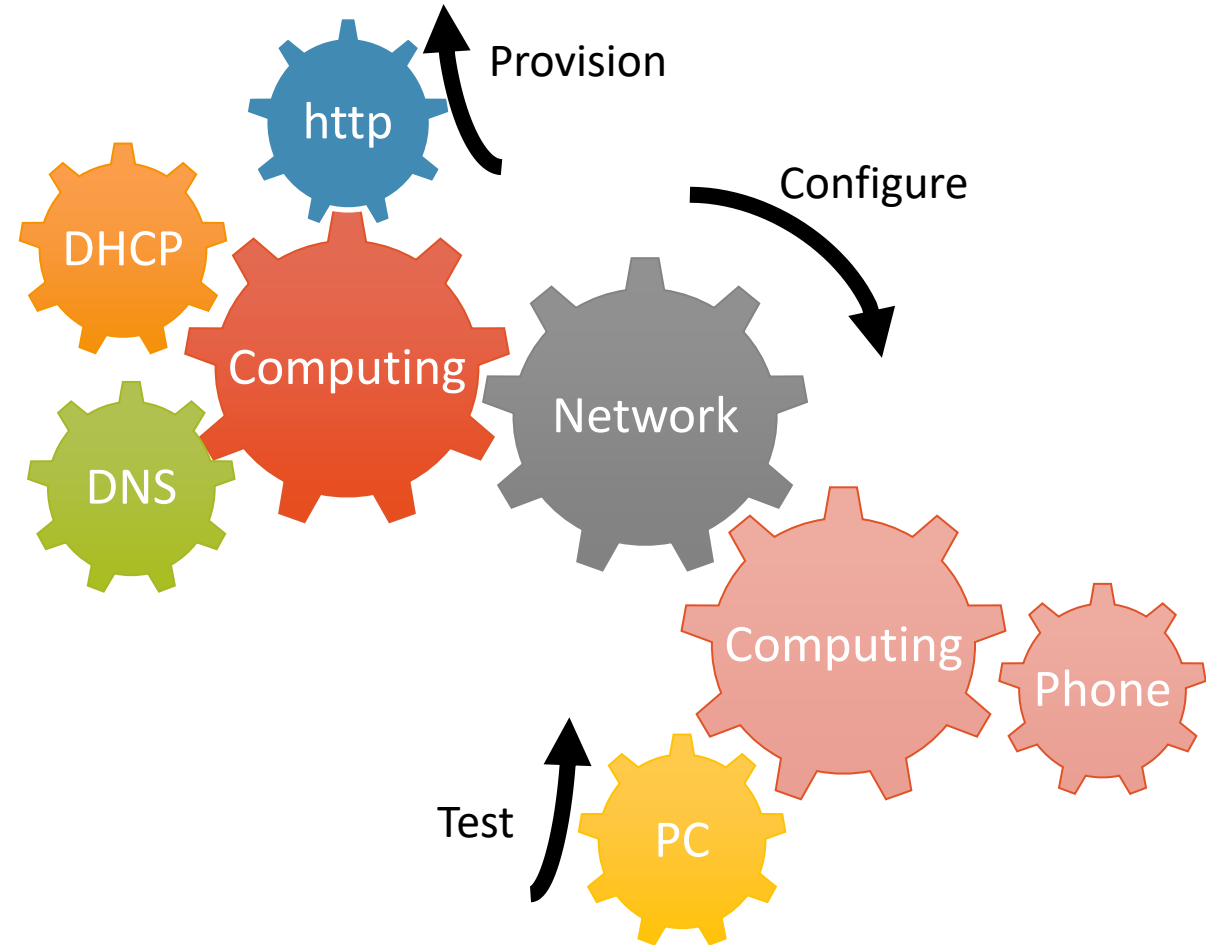
Common Purpose

Organized

IT System

A. What is a IT System?

a collection of computing and/or communications components and other resources that support one or more functional objectives of an organization



IT System Components

Services

Computing Machines

Software

Processes

Network

Users

IT System Components

Computing Machines are important component of IT Systems and there are different forms of computing machines in an organization

Software

Network

Services

Users

Processes

**Servers/
Workstation**



Dekstops



**Laptops/ Mobile
Devices**

IT System Components

Computing
Machines

Network

Services

Users

Processes



Operating Systems



Applications



Utilities

IT System Components

Computing
Machines

Software

Services

Users

Processes

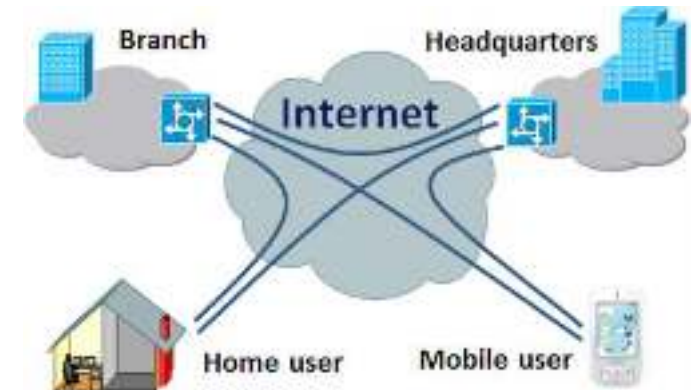
Wireless



Router
Switch
Firewall
DPI
Loadbalancers



Cable and Connectors



VPNs

IT System Components

Computing
Machines

Software

Network

Users

Processes

Application Services



Webservices



Network Services

IT System Components

**Computing
Machines**

Software

Network

Services

Processes

**Diverse
Users**

**Different
Roles**

**Different
Levels**

IT System Components

**Computing
Machines**

Software

Network

Services

Users

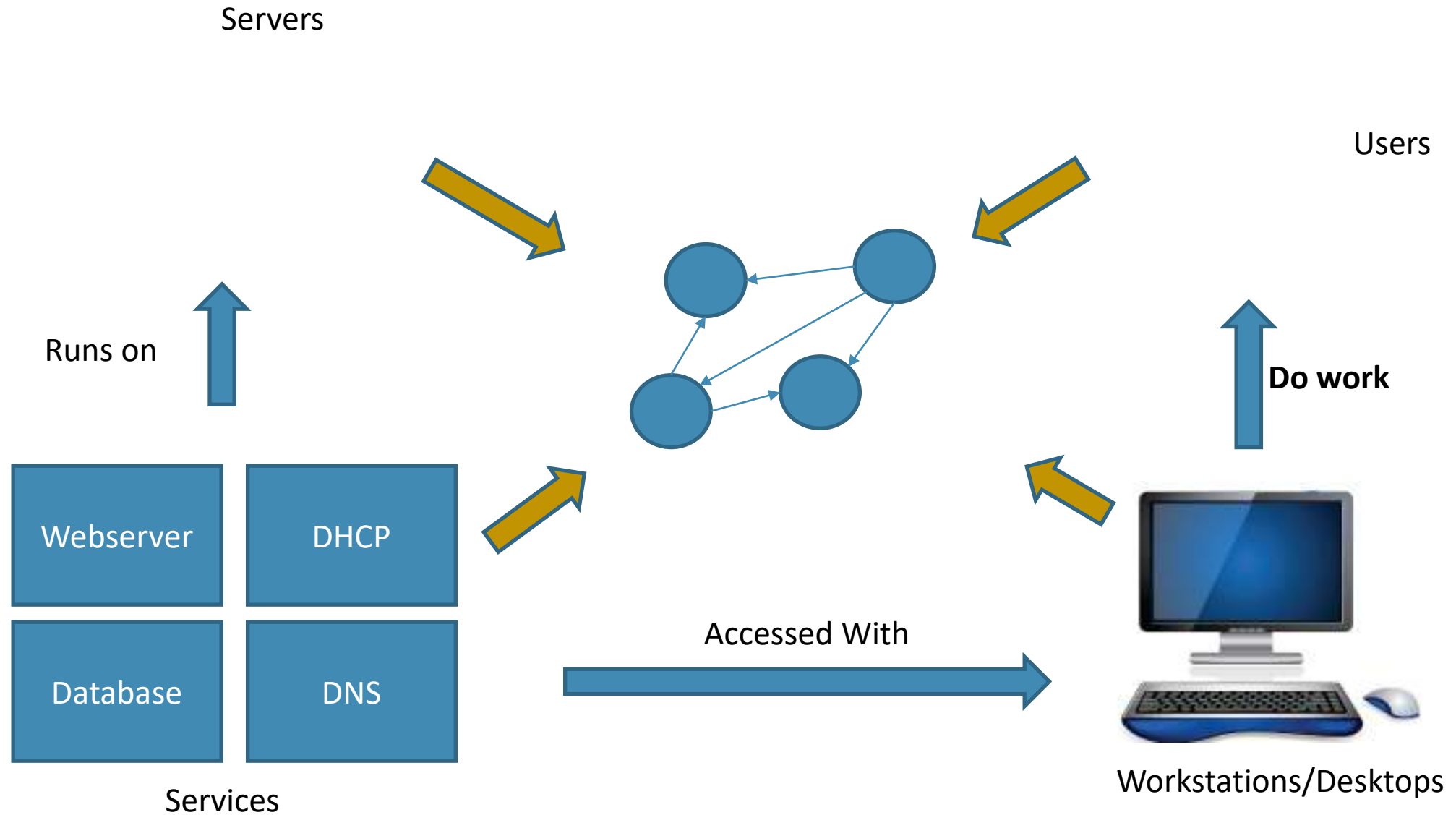
Support
System

Operations

Change
Managment

Configurations

IT System



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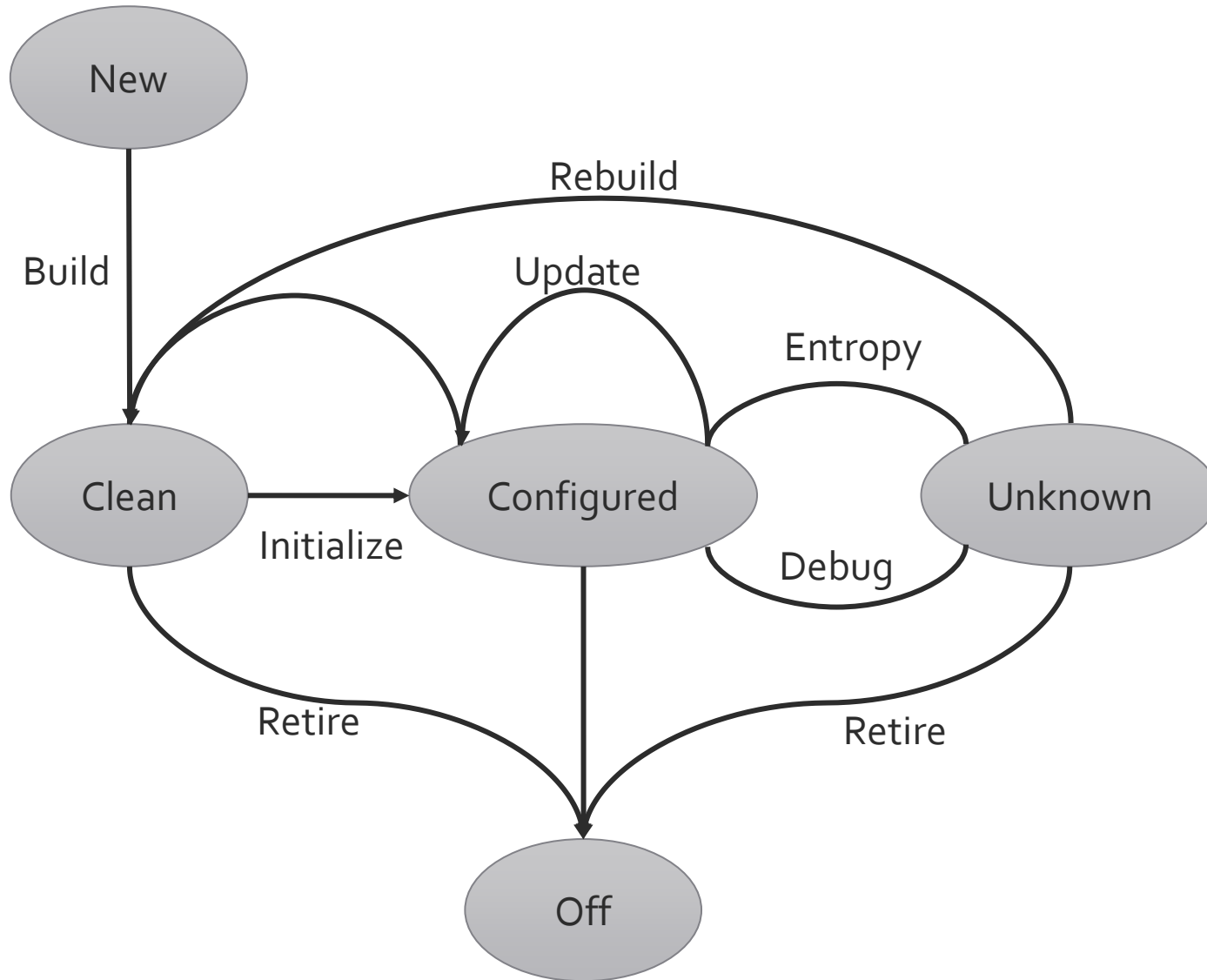
STATES OF COMPUTER MACHINES

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Computing Machines

- **A Computer Machine Consists of**
 - Hardware Components
 - Operating System
 - Accessories
 - Has Different States and Several Processes Associated with it
- **Evard's Computer Machine Life Cycle**
 - A Computer Machine Goes through different states in their life.
 - Evard has outline different states and process that are performance on

Evards ` Life Cycle Of Computer Machine



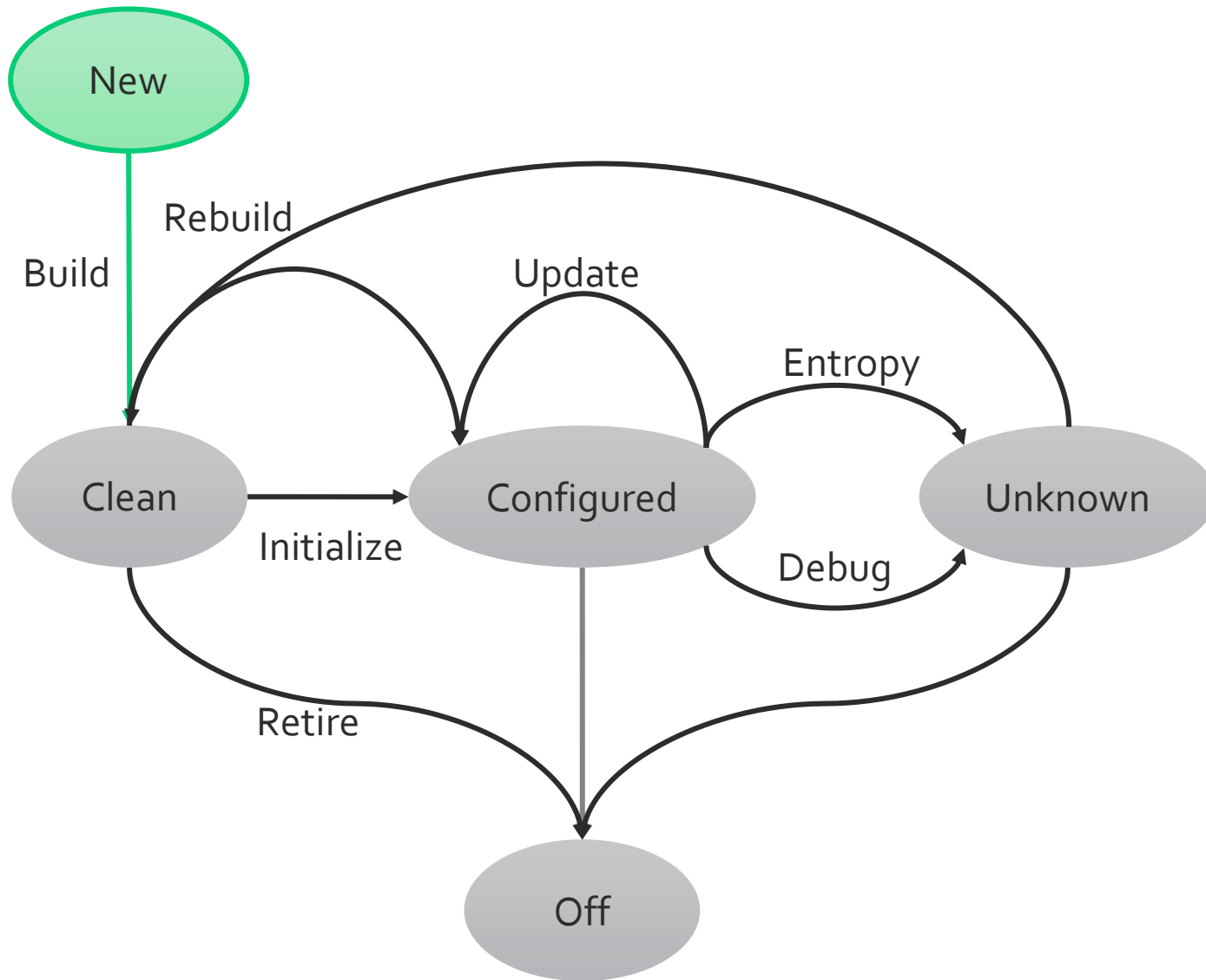
- **Five States**

- New
- Clean
- Configured
- Unknown
- Off

- **Several Processes**

- Build
- Initialize
- Update
- Entropy
- Debug
- Retire

Evards 'S Life Cycle Of Computer Machine



New State

A new machine

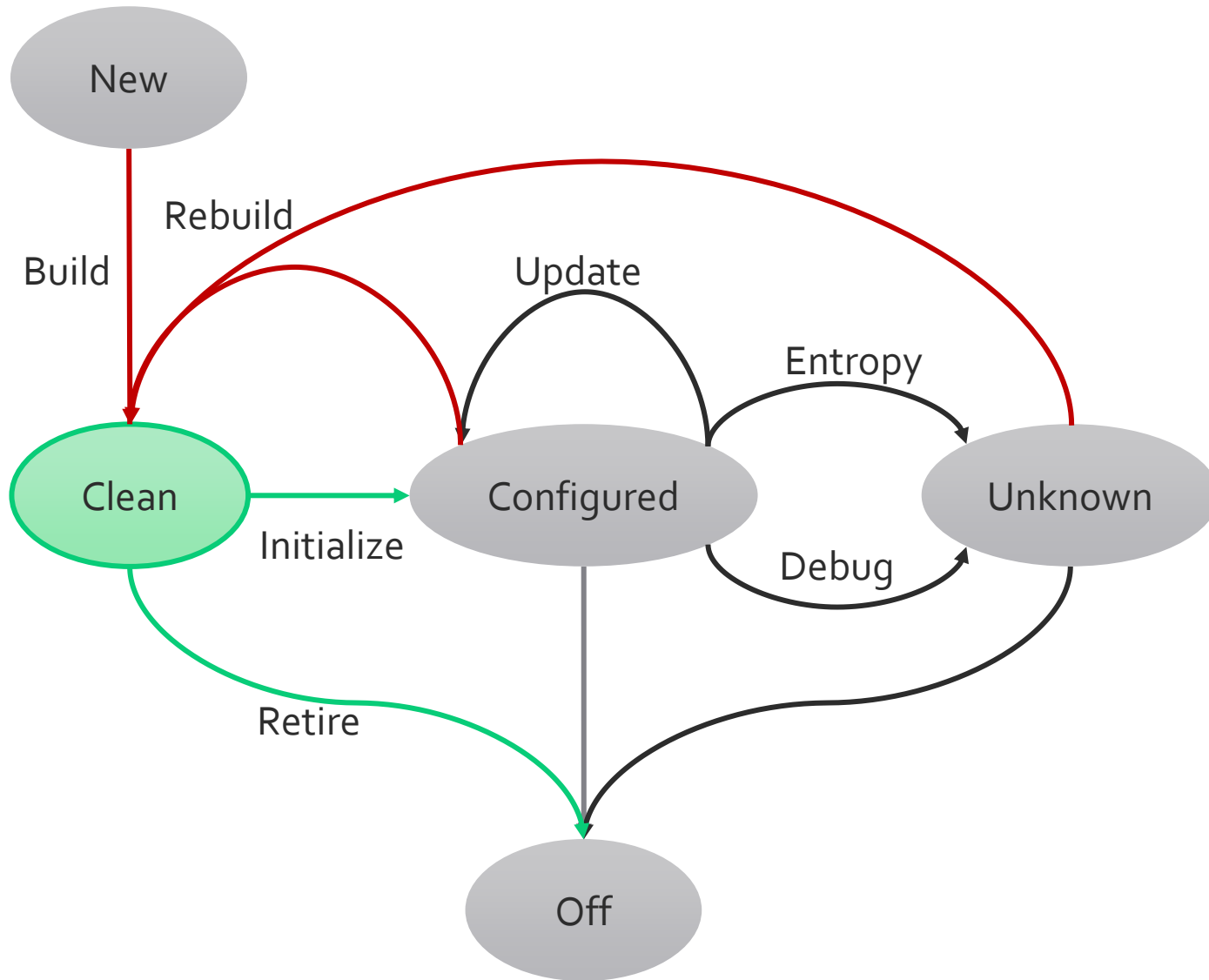
Unpacking

Physical Connections

Power up

Preinstalled OS or No OS

Evards 'S Life Cycle Of Computer Machine



Clean State

A machine that has the operating system installed but isn't set up to function in the System.

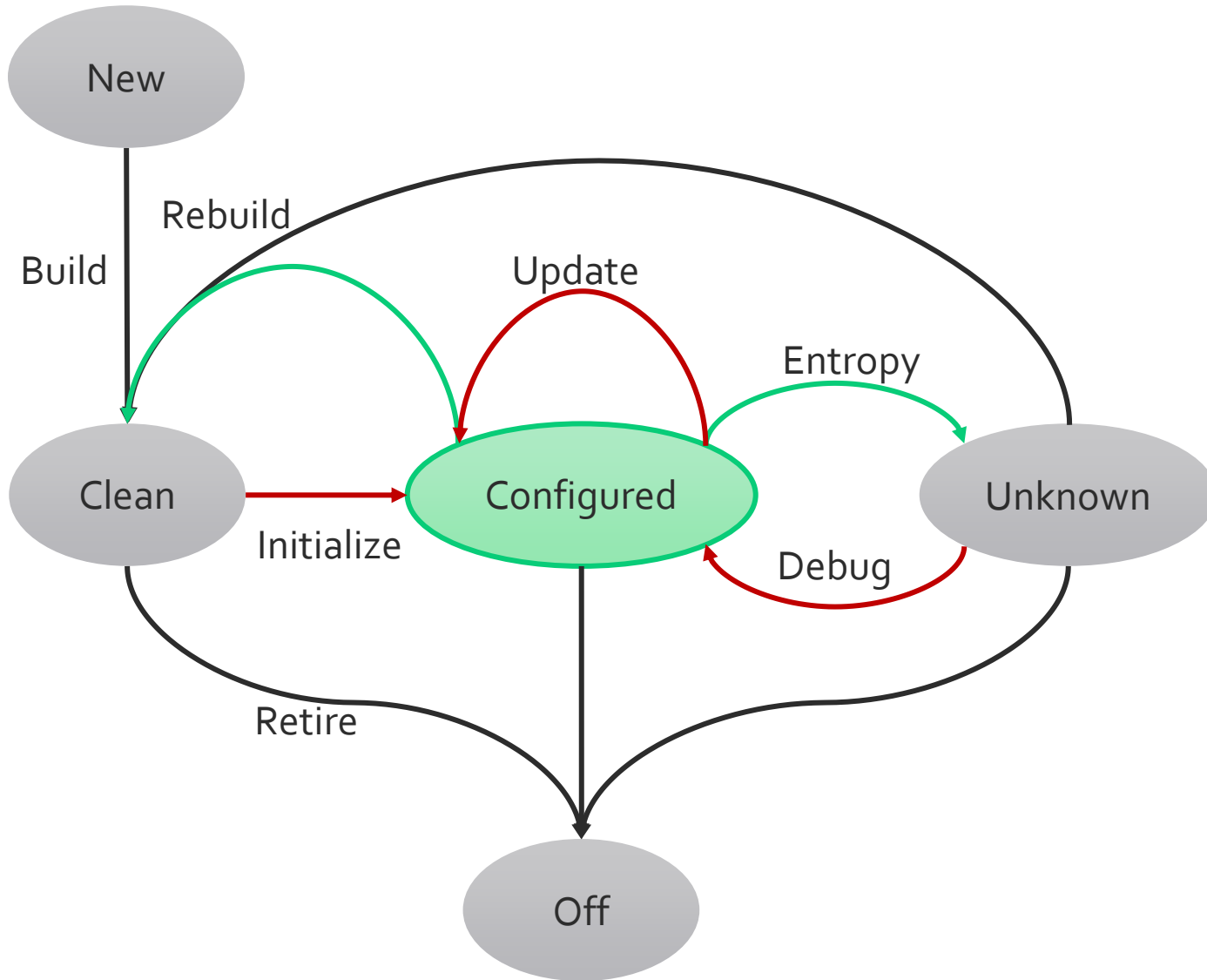
Build Process

- Select OS
- Install OS
- Drivers and Softwares

Rebuild Process

- Recovered Data
- Reformat Disks
- Reinstall OS/Software

Evards 'S Life Cycle Of Computer Machine



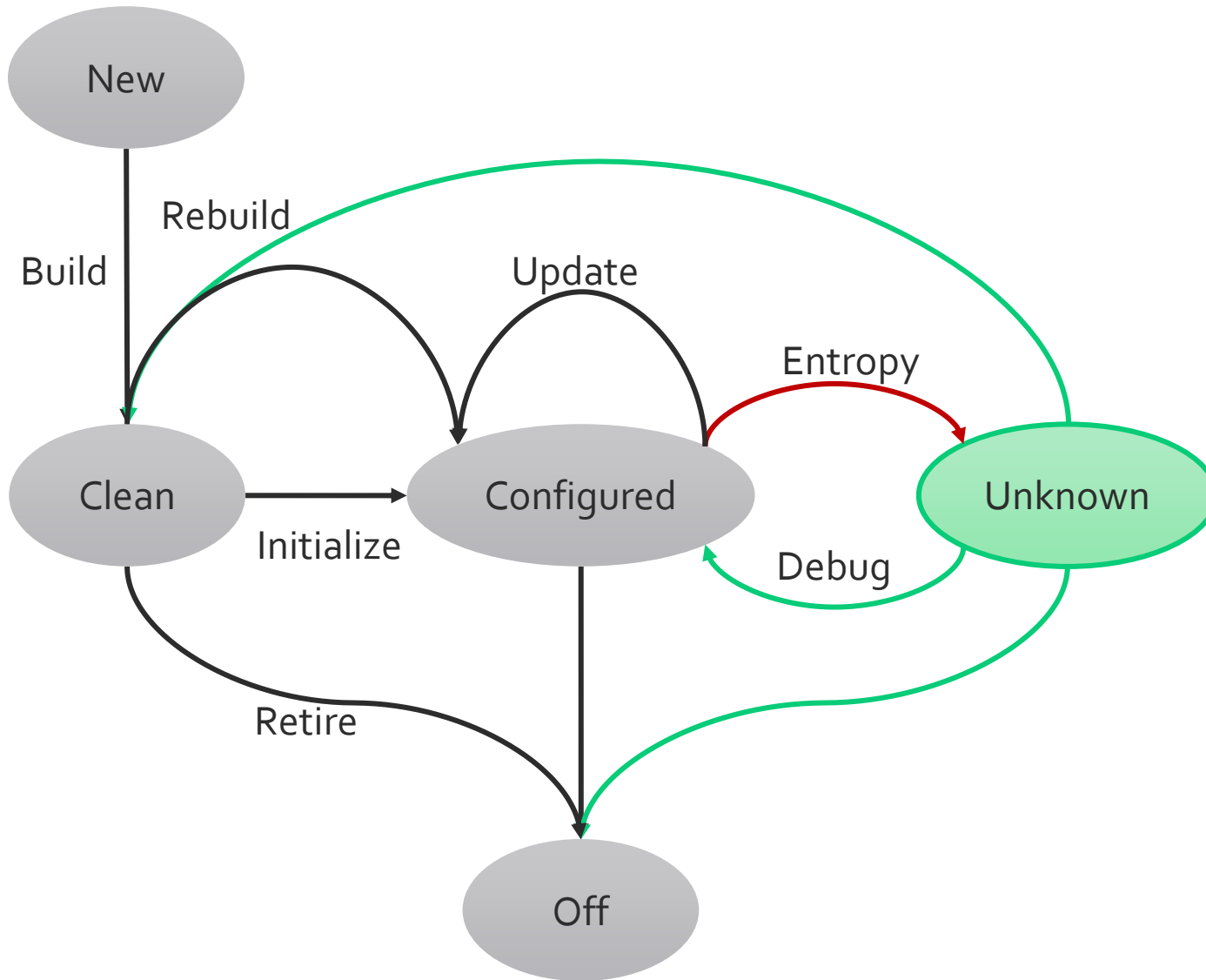
Configured State

- A machine that is properly configured to meet the needs of the System.
- User Roles and Permissions
- Updates

Update Process

Select Updates
Schedule Updates
Monitor

Evards 'S Life Cycle Of Computer Machine



Unknown State

- A machine that has been misconfigured, or that has become out of date, or that has been borrowed by an intern and returned stained

Debug Process

Troubleshooting
Remove the bugs
Fix Drivers and Softwares

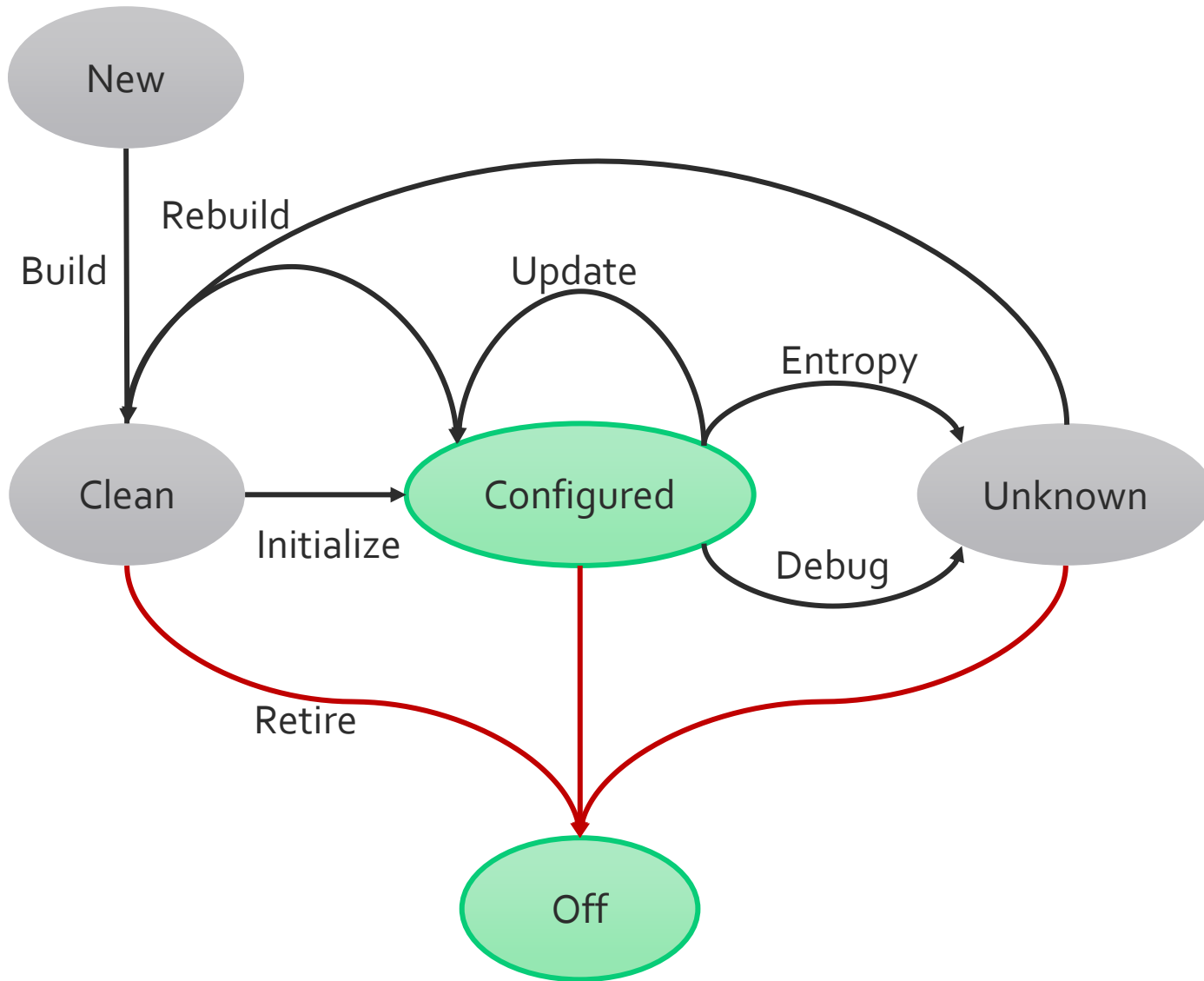
Entropy Process

Changes by user/admin/updates
Compromised State

Rebuild Process

Recover User Data
Formate Disks and Reinstall OS

Evards 'S Life Cycle Of Computer Machine



Off State

- Powered Off
- No User Data
- OS installed or Removed
- Disconnected from Infrastructure

Retire Process

- Recover User Data
- Flush the Hard Disks
- Isolate from Infrastructure

Summary

- Computer Machine Passes through 5 states throughout their life cycle
- Different Processes are used for transition of the state of Computer Machines

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What is SNA?

- **What is SNA and Who is System Administrator?**

1. Difficult to define because system administrators do so many things

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Computers



Networks

People

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Hardwares



OS



Security



Configs

SW & Apps

What is SNA?

2 - A system administrator influences how effectively other people can or do use their computers and networks.

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3 - A system administrator sometimes needs to be a

4 - Known with different names.

General Definition

System administration is the field of work which involves...

- **Managing one or more systems,**
- **System could be software, hardware, servers or workstations.**
- **The objective are efficiency and effectiveness**

- **System administration matters because computers and networks matter.**



- **Business Depends on**



- **Management now has a more realistic view of computers, More people becoming direct users of Computers**
- **Unreliable machine room power system that caused occasional but bearable problems now prevents sales from being recorded.**
- **Computers matter more than ever. If computers are to work and work well, system administration matters**

- **Small and Home Offices:**

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- **Mid-market enterprise:**

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- **Large enterprise:**

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Managing an IT System means?

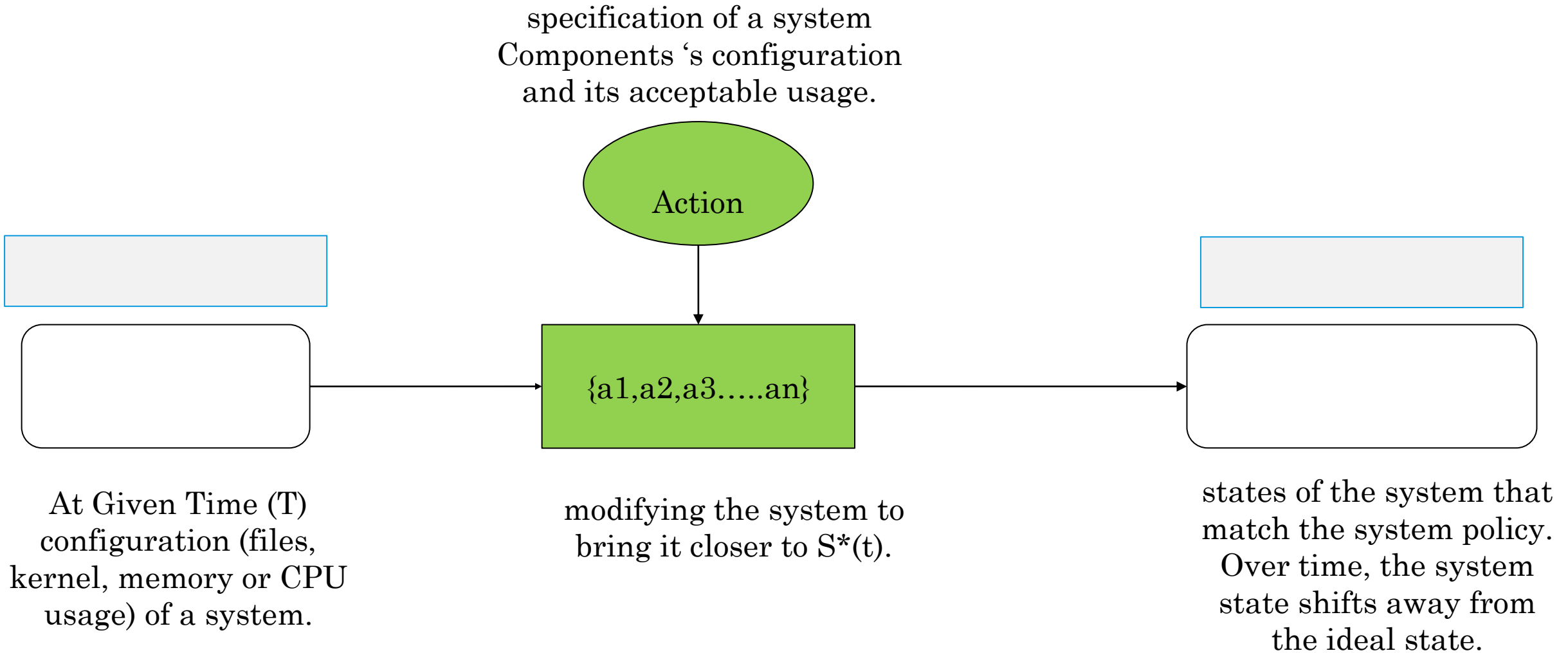
Applying Tasks and actions

- **Installation and Configuration**
- **Monitoring, Logging and Reporting**
- **Changing**
- **Supporting**
- **Provisioning**
- **Troubleshooting**



**Changes
System State**

Formal Definition of System Administration



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Week # 2

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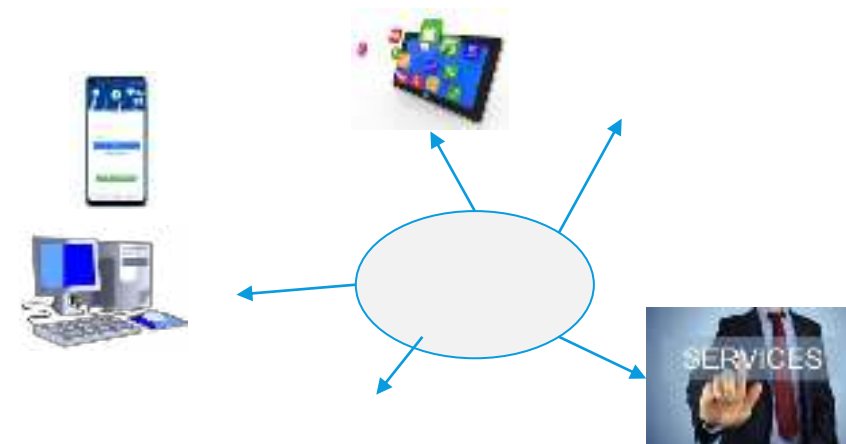
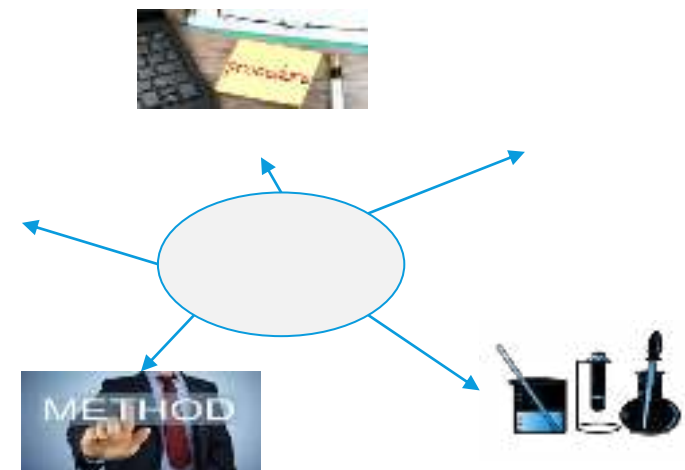
Maturity Model

What is a process?

- **Maturity model in IT?**
- **System Administration Maturity Model**



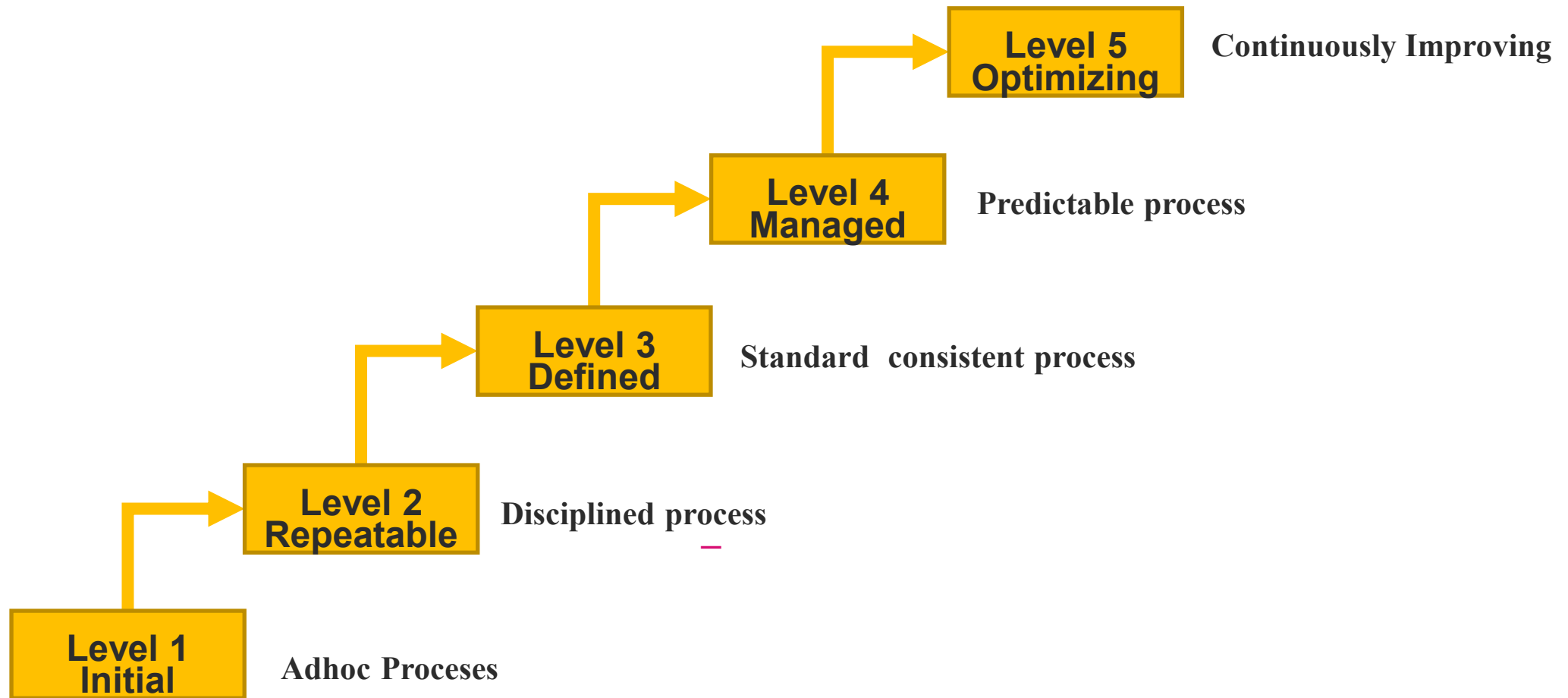
Maturity

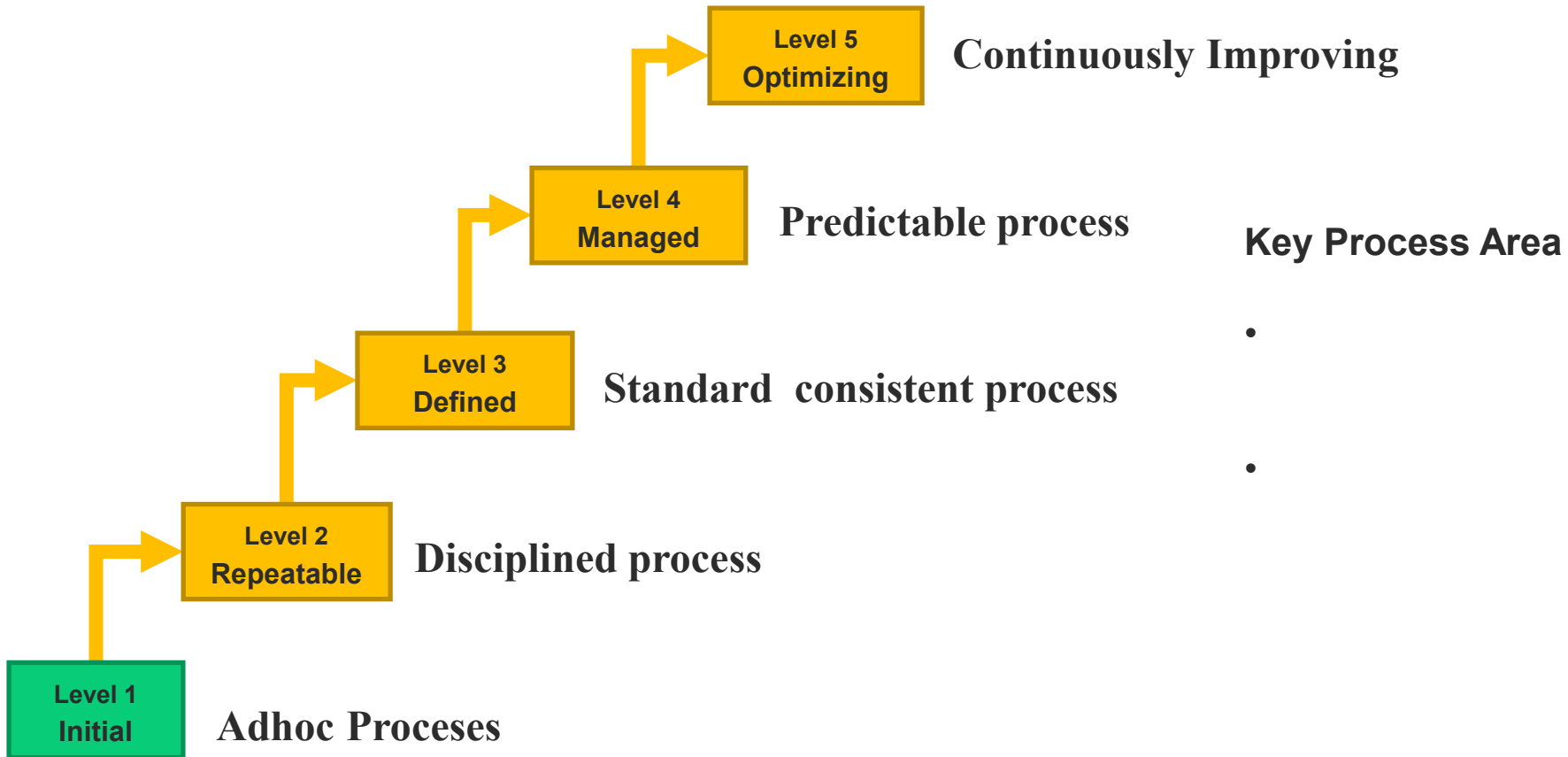


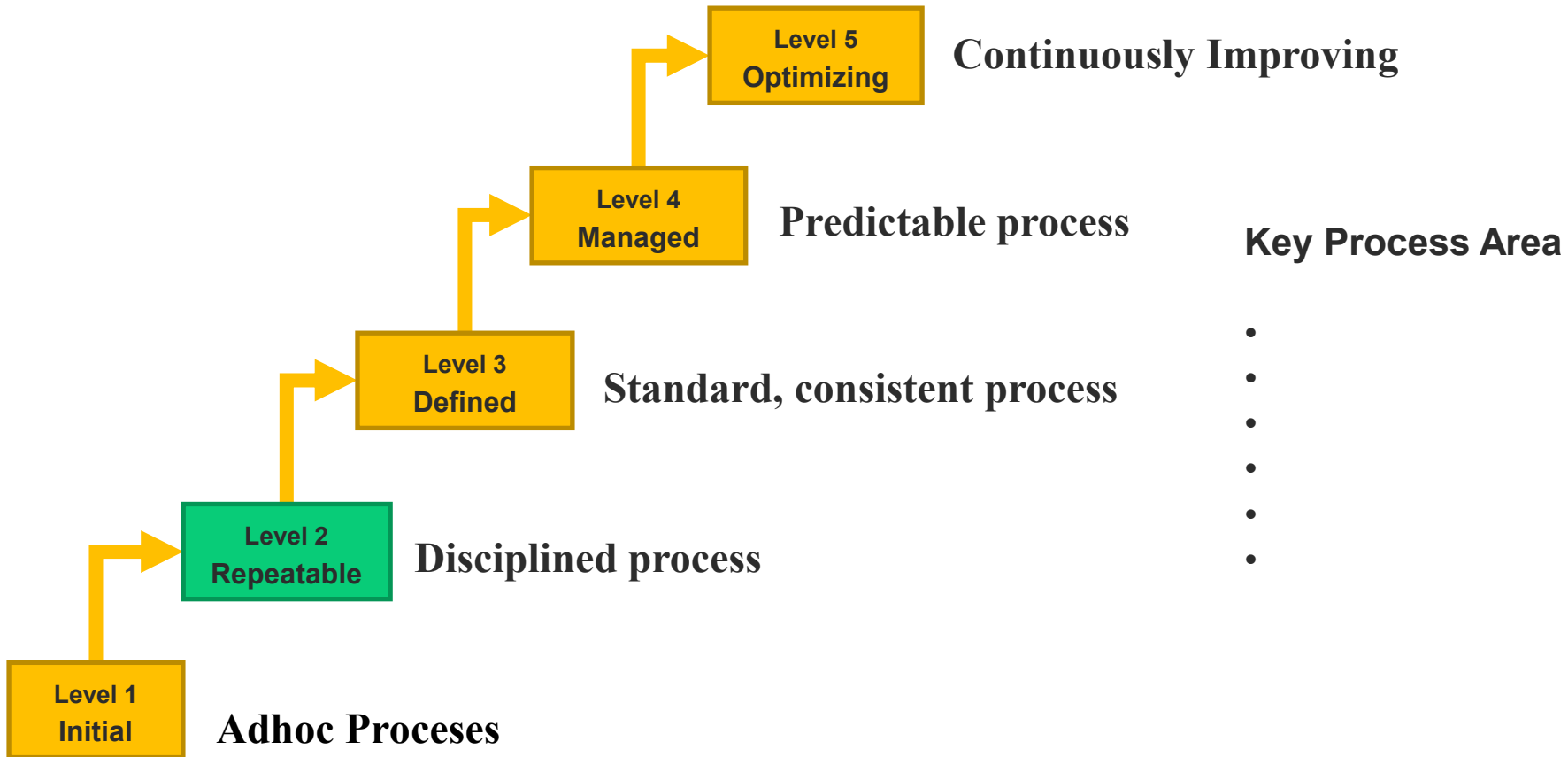
Several maturity models exists for IT and Business, Examples are....

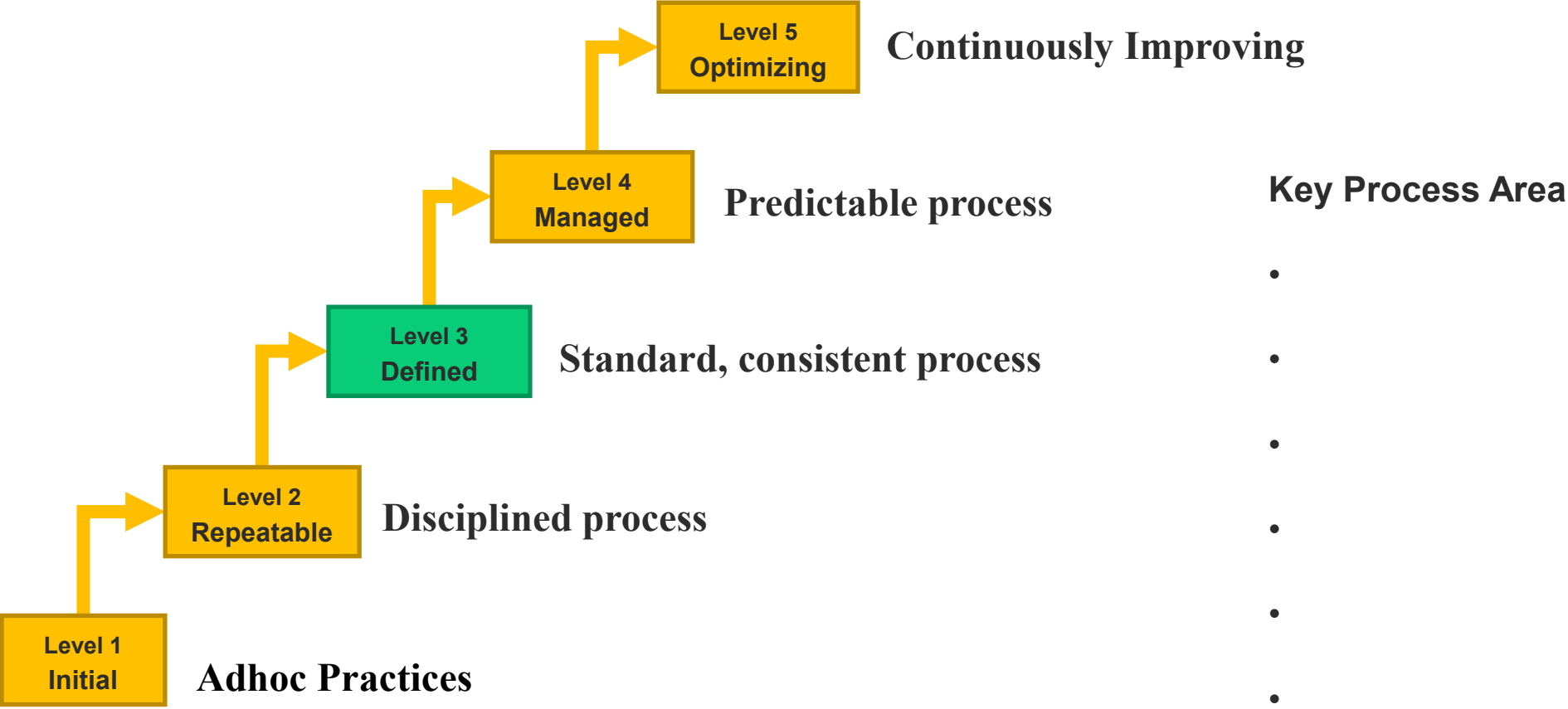
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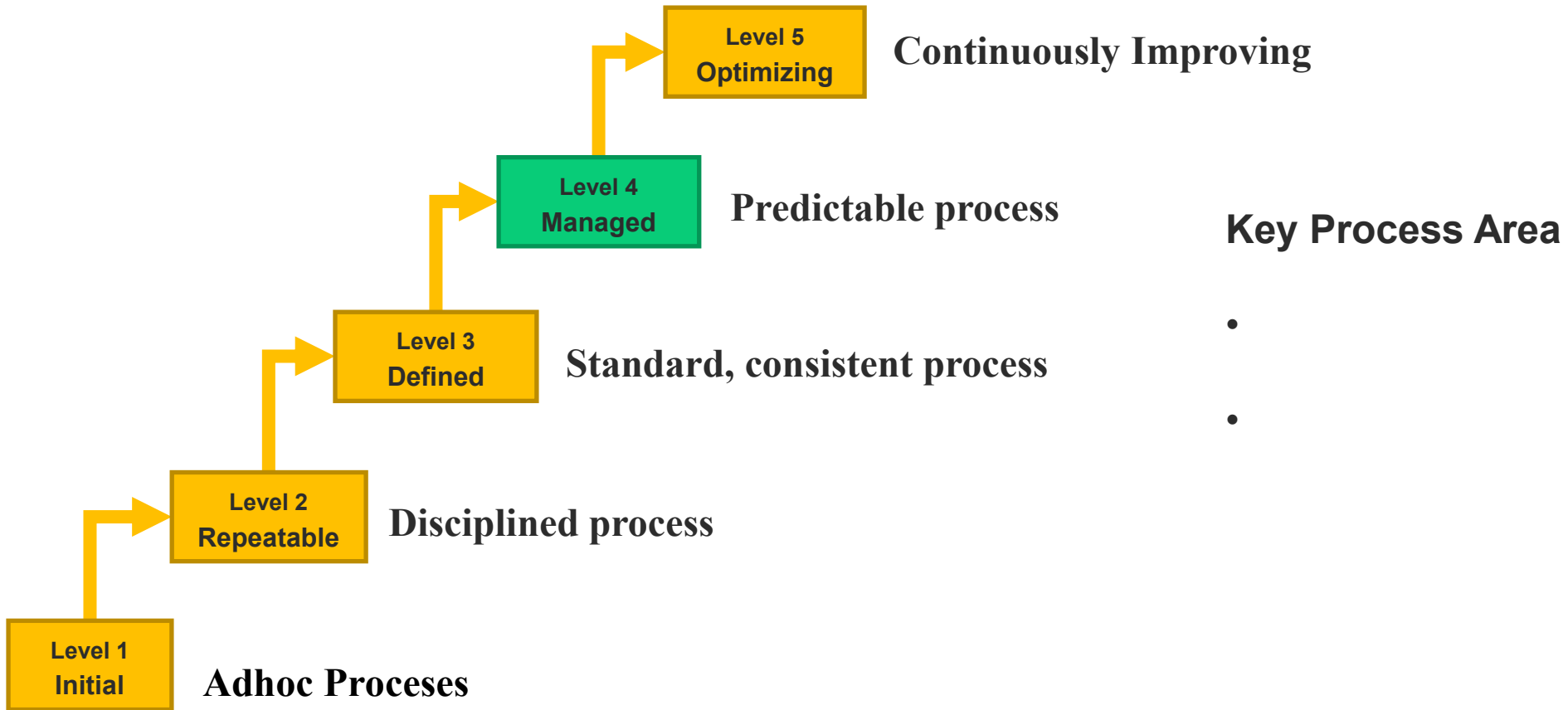
We Focus on System Administration Maturity Model (SAMM) which is quite similar to ITIL Maturity Model.

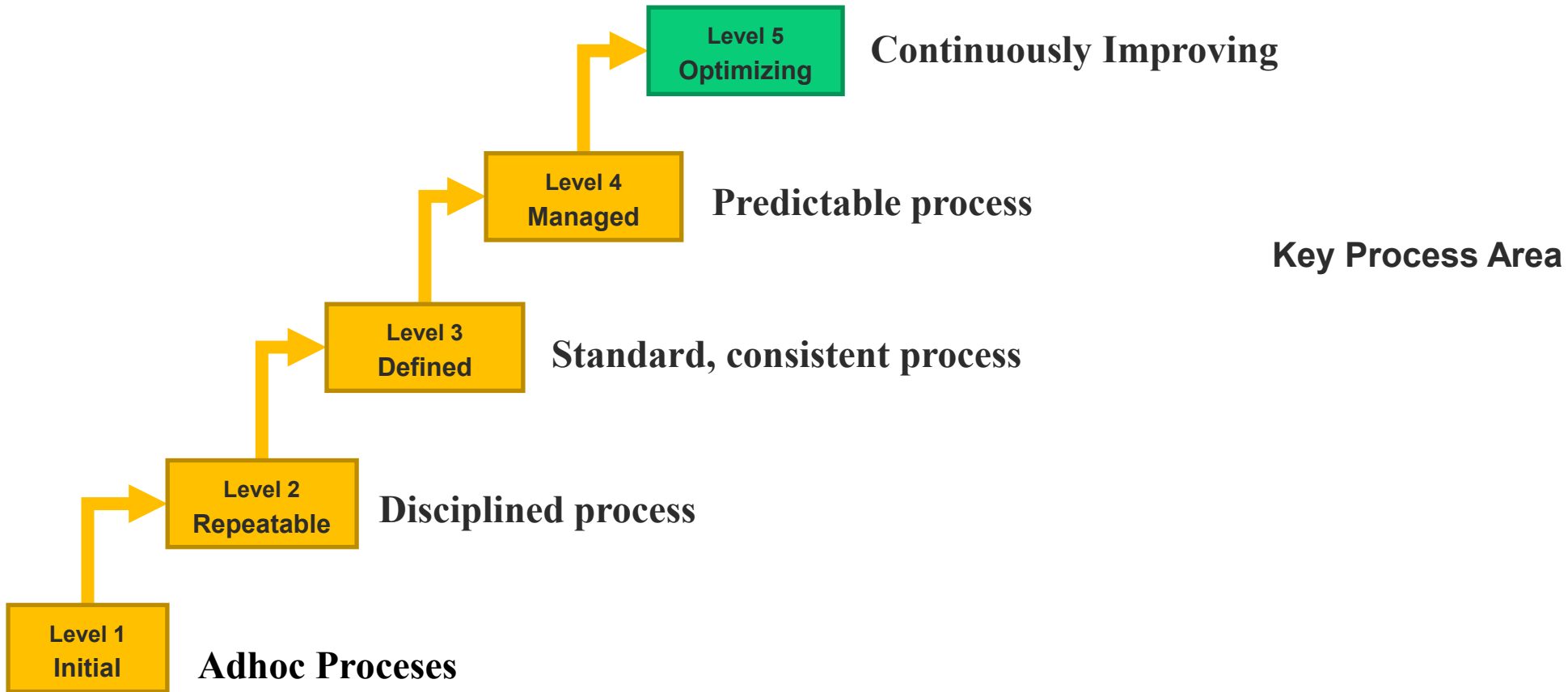












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New user —

Software install —

Hardware install —

Problem report —

Security —

Disk capacity —

Backups —

New user –

Software install –

Hardware install –

Problem report –

Security –

Disk capacity –

Backups –

New user –

Software install –

Hardware install –

Problem report –

Security –

Disk capacity –

Backups –

New user –

Software install –

Hardware install –

Problem report –

Security –

Disk capacity –

Backups –

New user –

Software install –

Hardware install –

Problem report –

Security –

Disk capacity –

Backups –

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To quantify how “reliable” a product or service is,

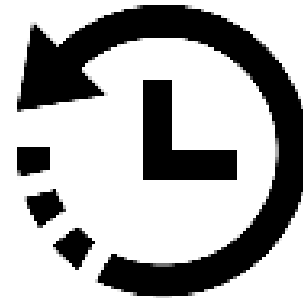
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Defining Reliability

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The Reliability is calculated

$$r(t) = \frac{N_w(t)}{N(t_0)}$$

$$r(T)$$

$$N_w(T)$$

$$N(T_0)$$

$$f(t) = \frac{N_{nw}(t)}{N(t_0)}$$

$$= 1 - R(t)$$

$$F(T) = \frac{N_{nw}(T)}{N(T_0)}$$

- usually denoted by the λ .

$$\lambda(t) = \frac{N_w(t) - N_w(t + dt)}{dt * N(t)}$$

$$\lambda(t)$$

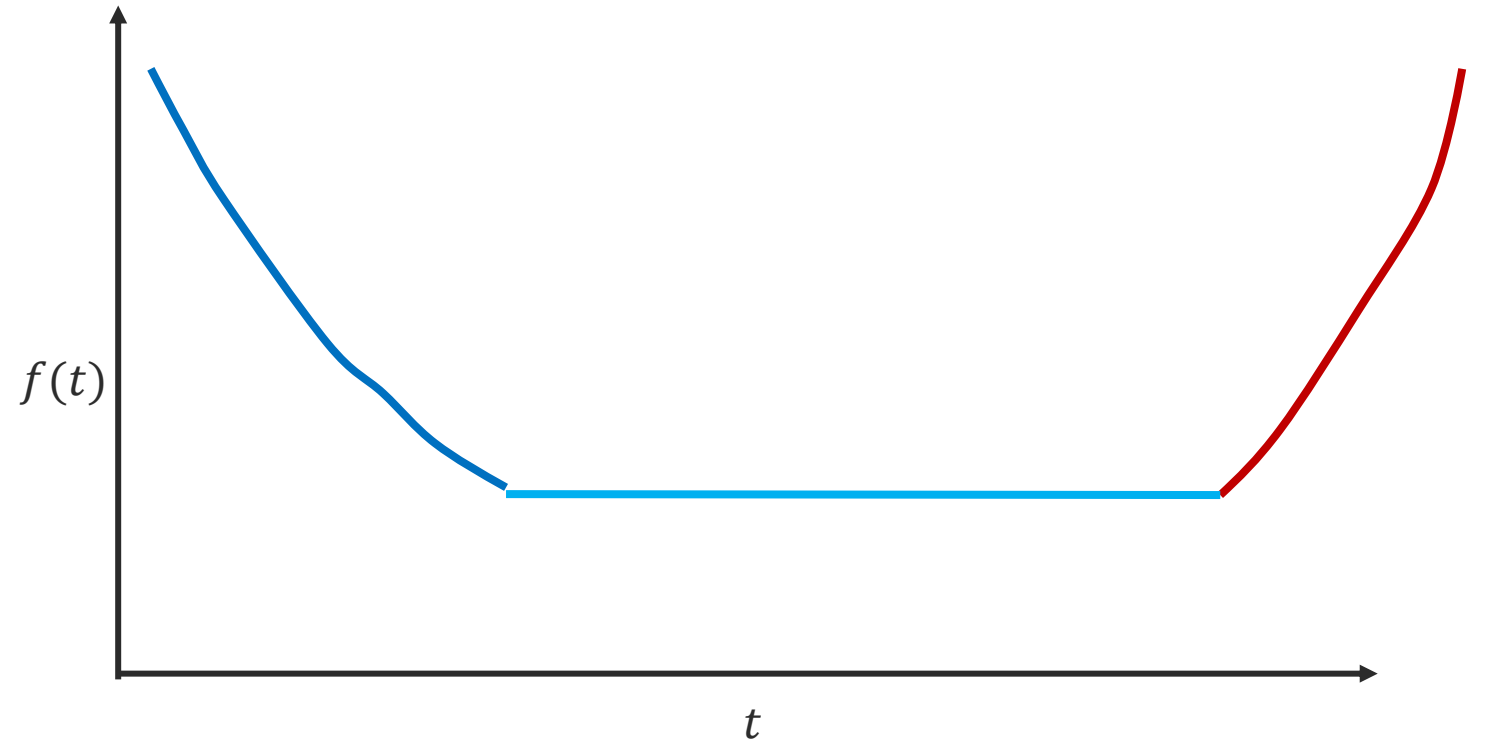
$$r(t) = e^{-\left(\frac{t}{\alpha}\right)^\beta}$$

α

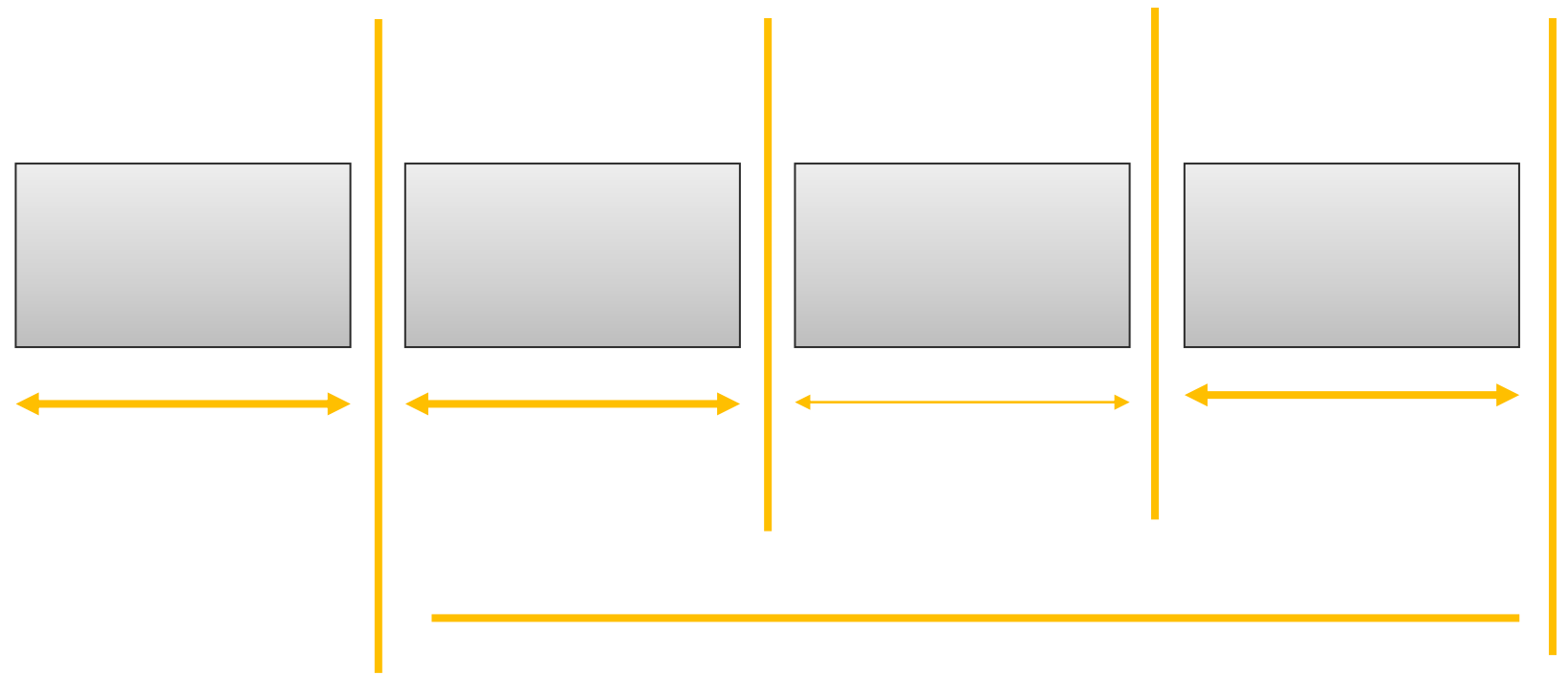
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β

- $\beta < 1$
- $\beta = 1$
- $\beta > 1$



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- The frequency of component failure per unit time denoted by λ .

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$$\lambda = \frac{1}{MTBF} = \frac{1}{MTTF}$$

- component per unit time and denoted μ .

-

$$\mu = \frac{1}{MTTR}$$

Mean time to failure (MTTF)

$$MTTF = \frac{\textit{Total Functional Hours}}{\textit{Total Units}} = \frac{1}{\lambda}$$

$$MTBF = \frac{\textit{Total Functional Hours}}{\textit{Total Failures}} = \frac{1}{\lambda}$$

$$MTBD = MTTF + MTTR$$

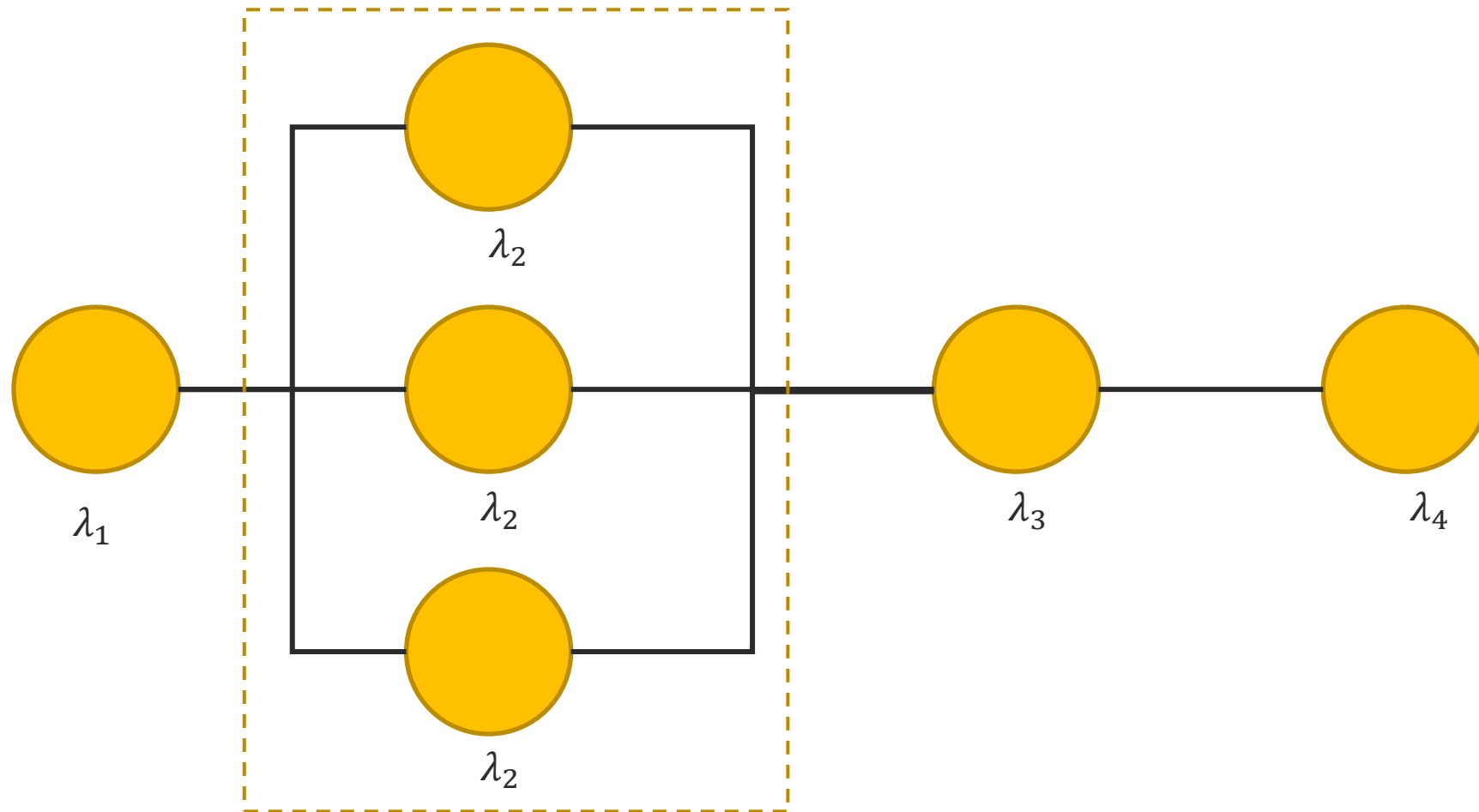
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$$MTTR = \frac{\textit{Total Maintenance Hours}}{\textit{Total Repairs}} = \frac{1}{\mu}$$

$$MTD = \frac{\textit{Total Hours of Incident Detection}}{\textit{Total Incidents}}$$

$$Availability = \frac{MTBF}{MTBF + MTTR}$$



- For series connected components, the effective failure rate is determined as the sum of failure rates of each component. Given n series-connected components:

$$\lambda = \sum_{i=1}^n \lambda_i$$

-

$$MTTF = \sum_{i=1}^n \frac{1}{\lambda_i}$$

-

Availability and Reliability specifications

- Calculate reliability and availability of each component individually. For series connected components, compute the product of all component values. for N series-connected components.

$$R(t) = \prod_{i=1}^n R_i(t) \quad , \quad A(t) = \prod_{i=1}^n A_i(t)$$

- For parallel connected components, for N parallel-connected components.

$$R(t) = 1 - \prod_{i=1}^n (1 - R_i(t)) \quad , \quad A(t) = 1 - \prod_{i=1}^n (1 - A_i(t))$$

- For hybrid connected components, reduce the calculations to series or parallel configurations first.

Caveats

- It's important to note a few caveats regarding these incident metrics and the associated reliability and availability calculations.
 -
 -
- Organizations should therefore map system reliability and availability calculations to business value and end-user experience.
- Decisions may require strategic trade-offs with cost, performance and, security, and decision makers will need to ask questions beyond the system dependability metrics and specifications followed by IT departments.

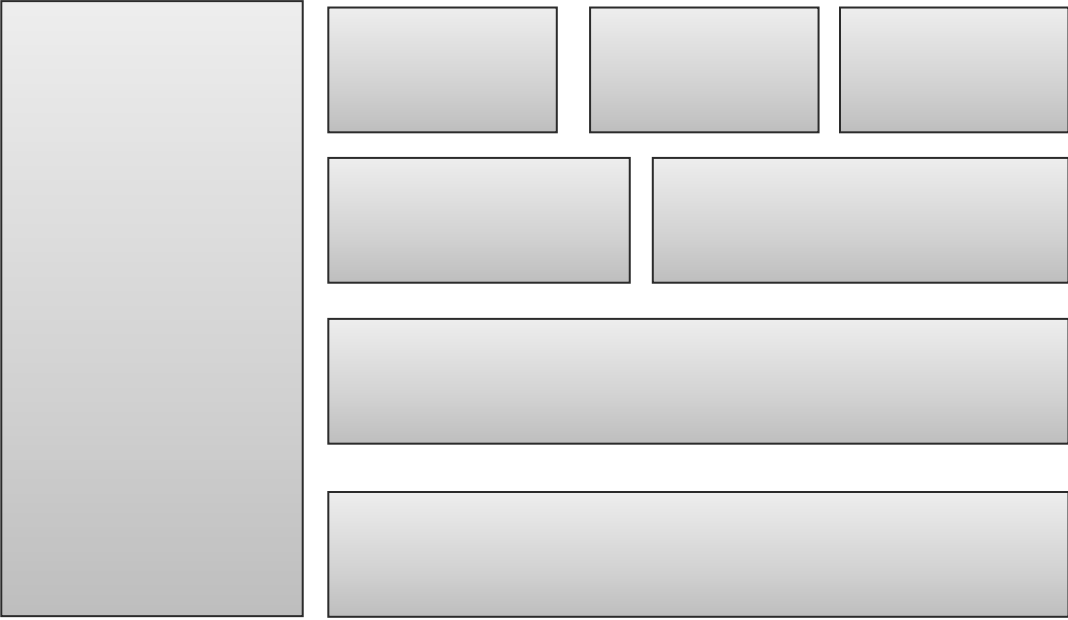
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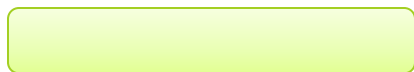
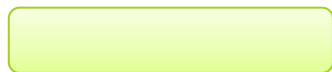
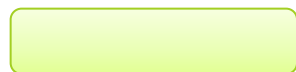
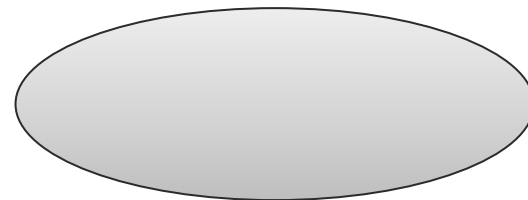
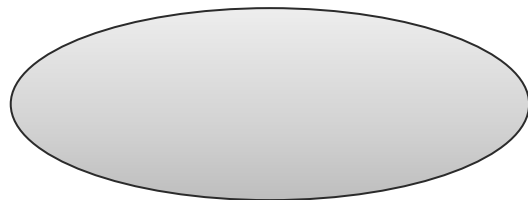
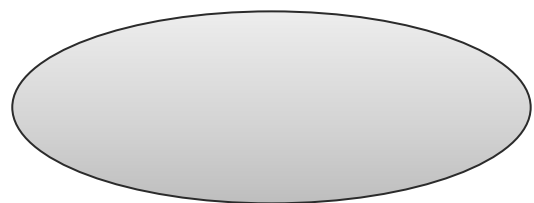
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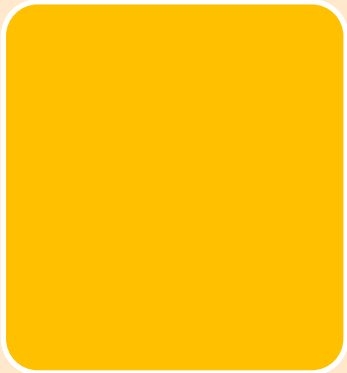
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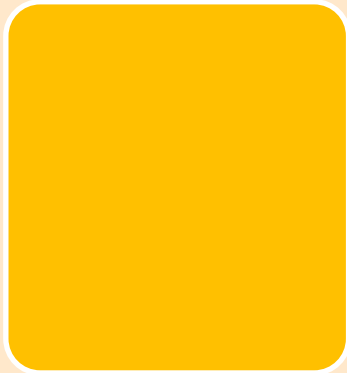




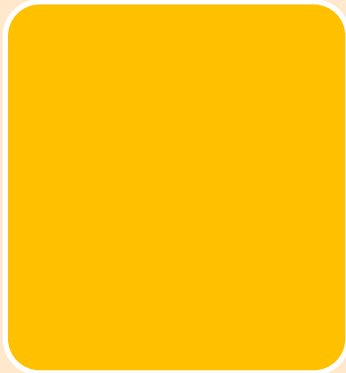
**Adding and
removing hardware**



Purchase



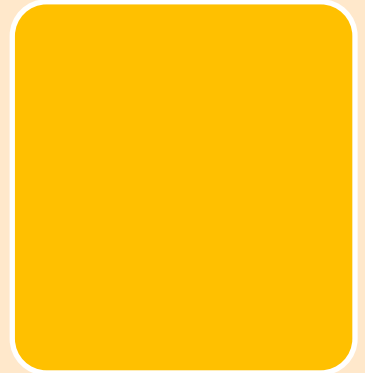
Capacity planning

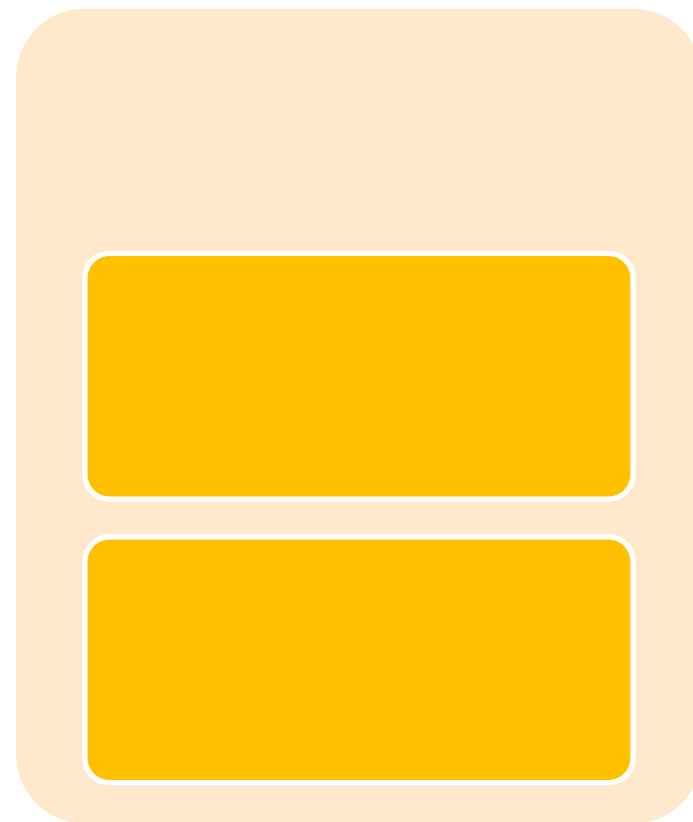
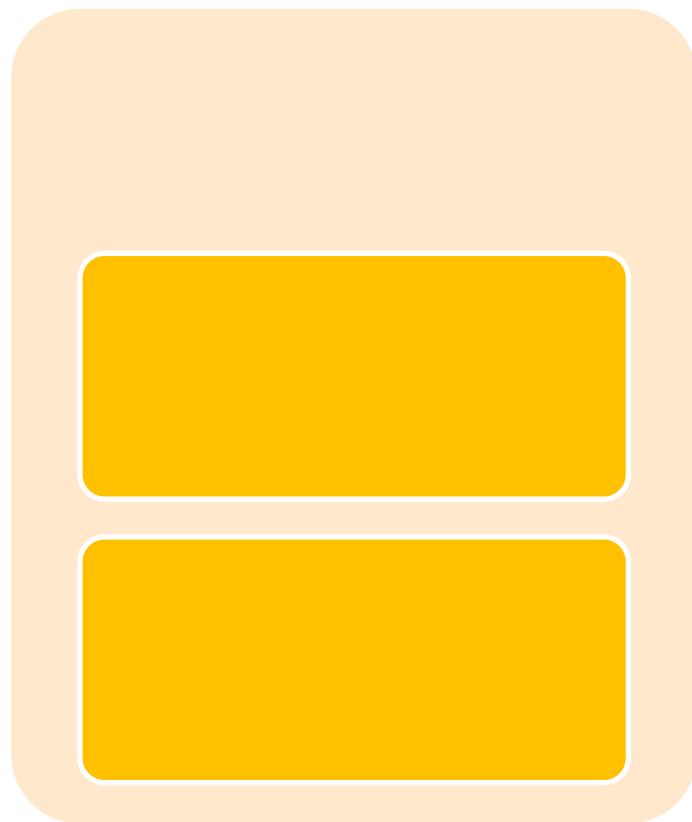
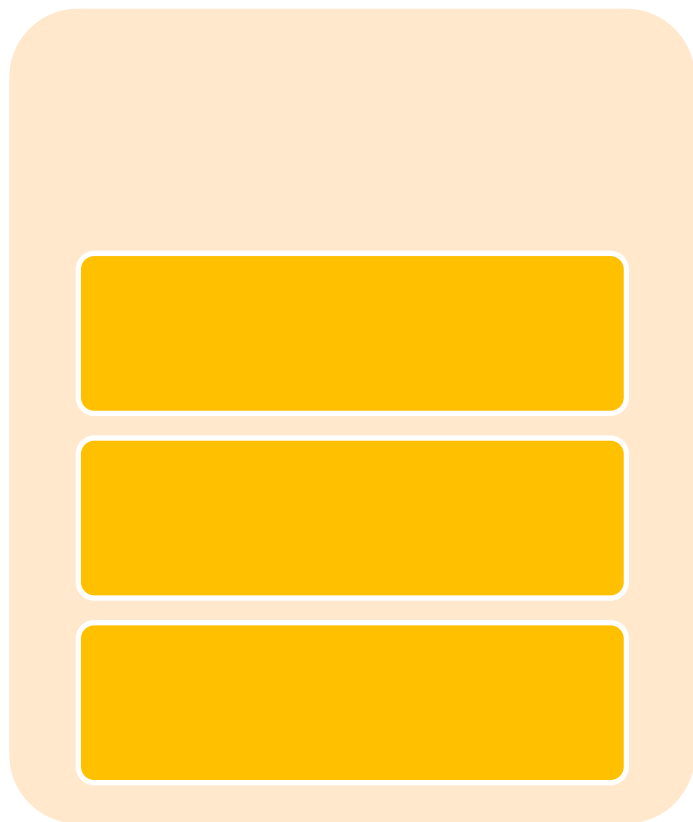


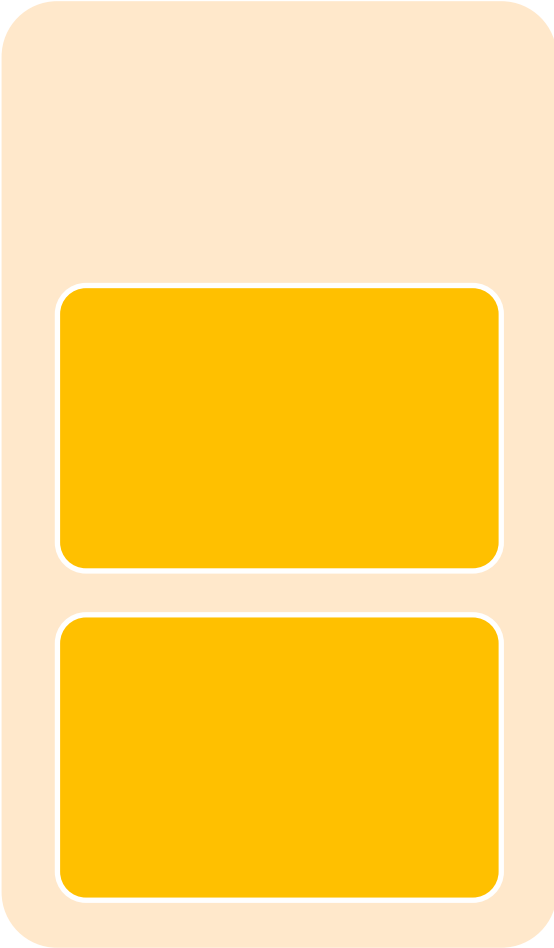
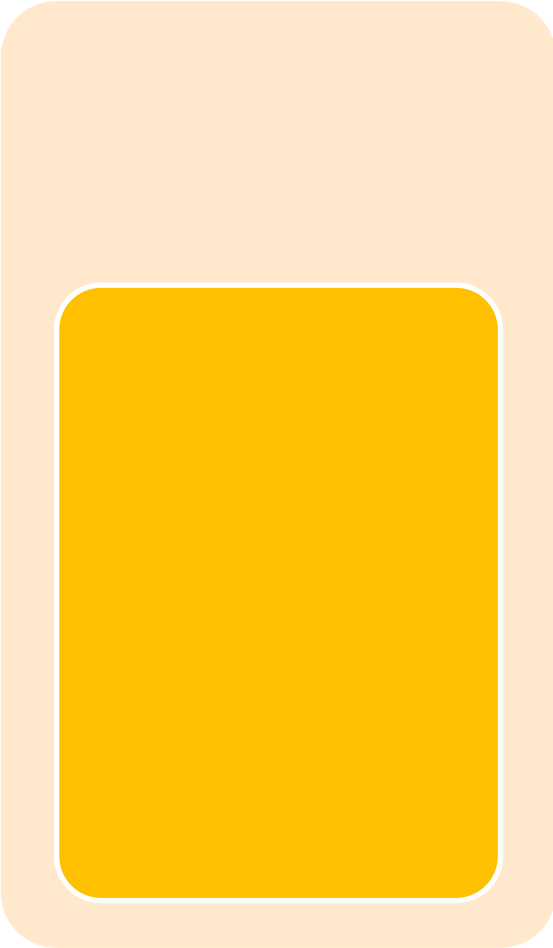
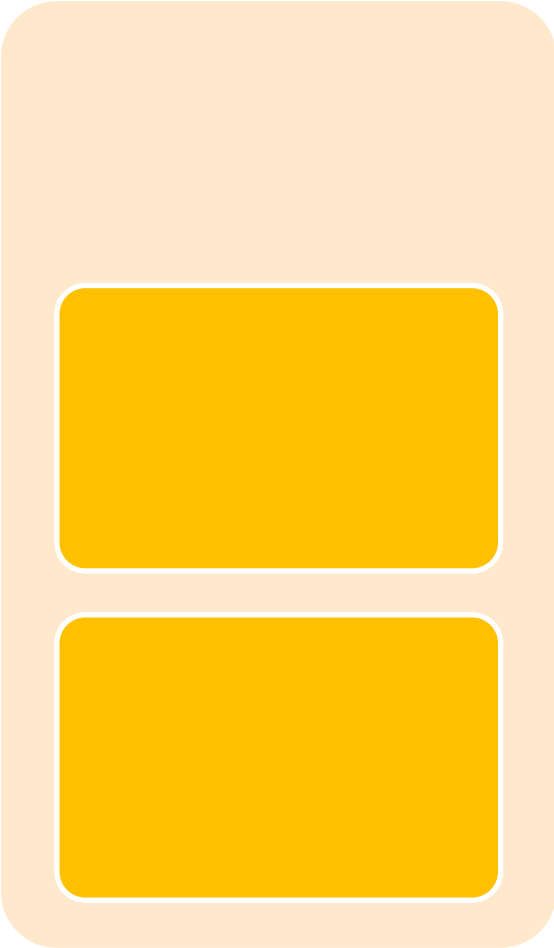
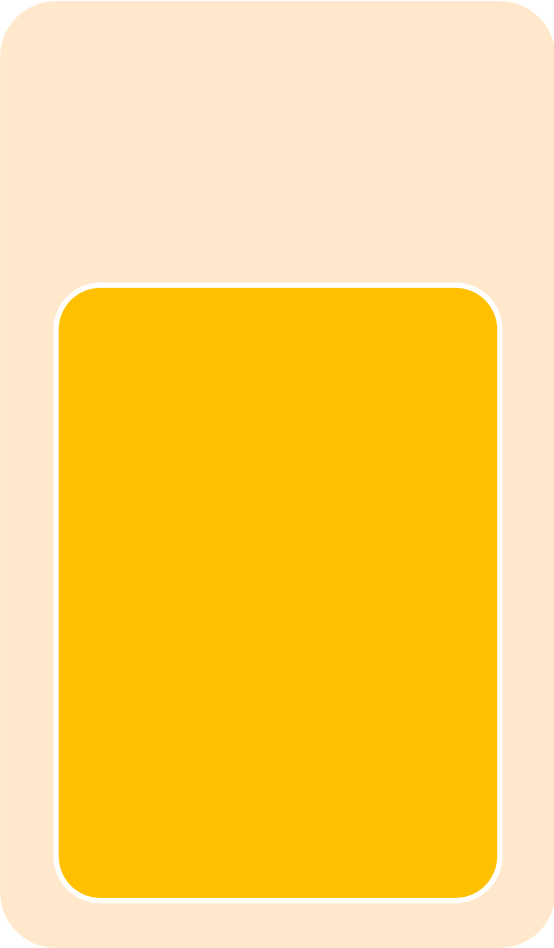
**Data Center
management**



Virtualization







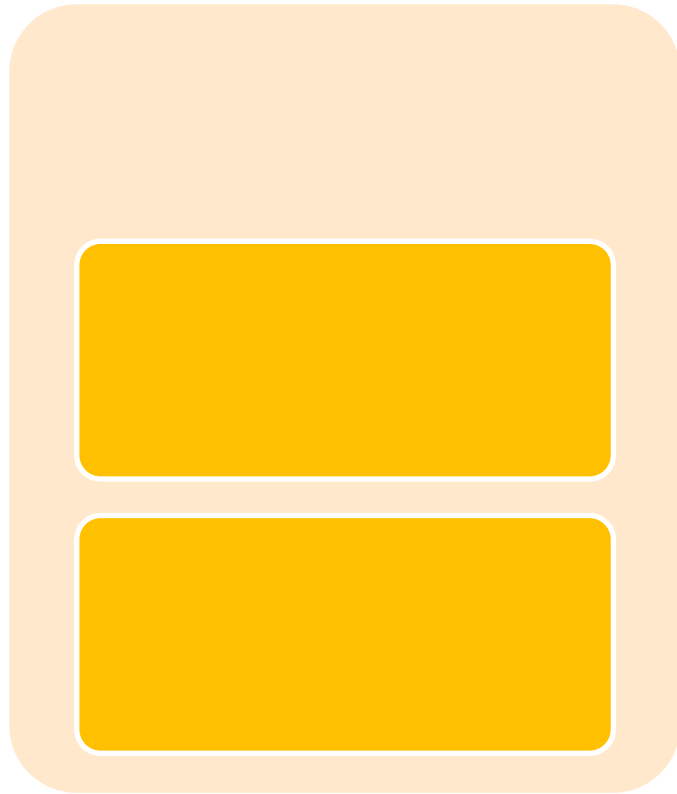


Diagram showing a light orange rounded rectangle containing two stacked yellow rounded rectangles, representing a task or project.

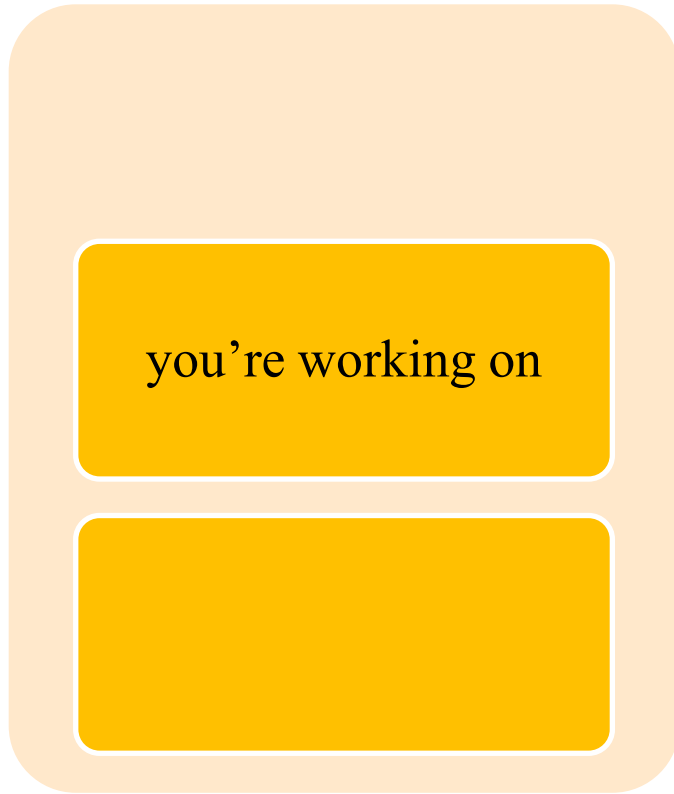


Diagram showing a light orange rounded rectangle containing two stacked yellow rounded rectangles. The top yellow rectangle contains the text "you're working on", indicating the current task or project.

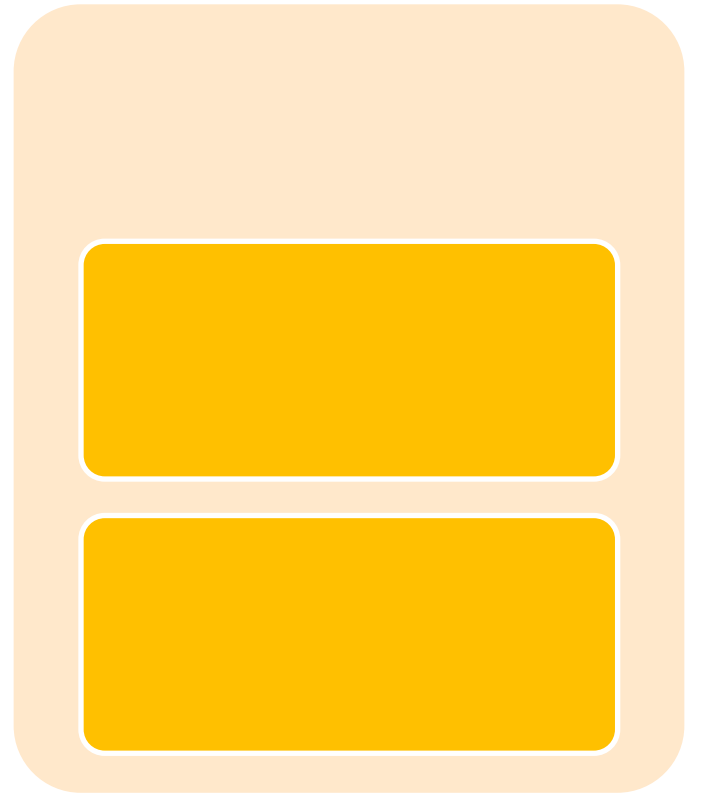
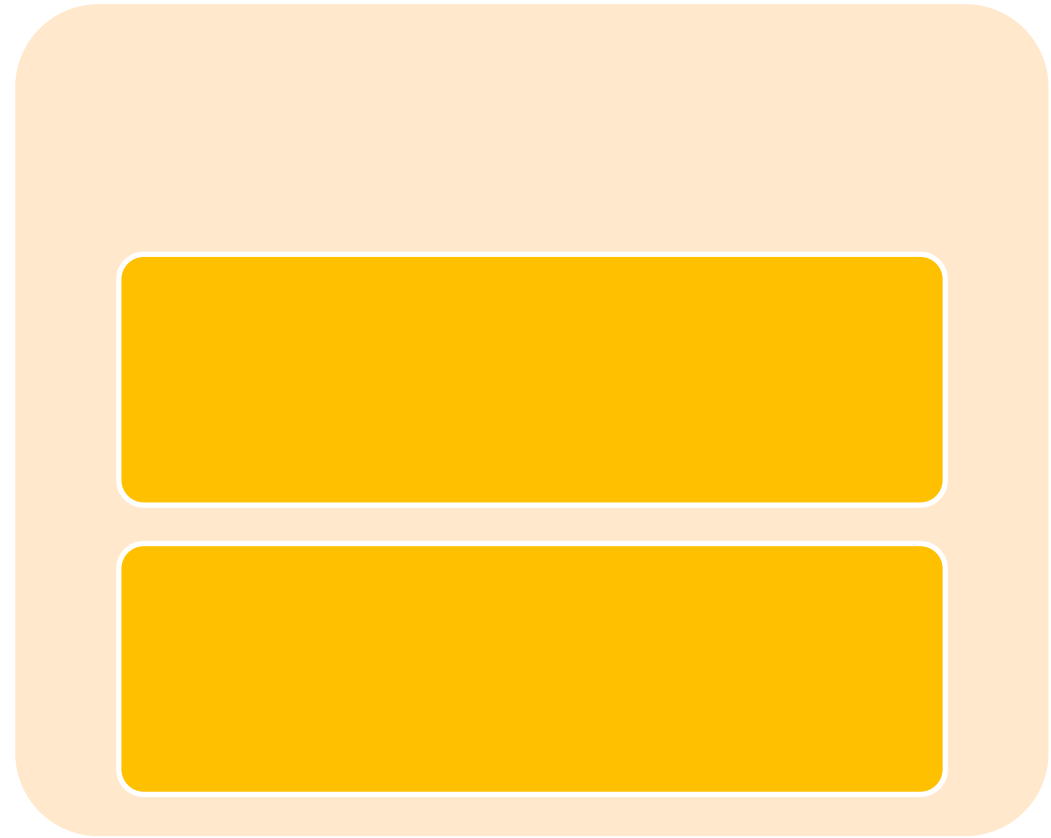
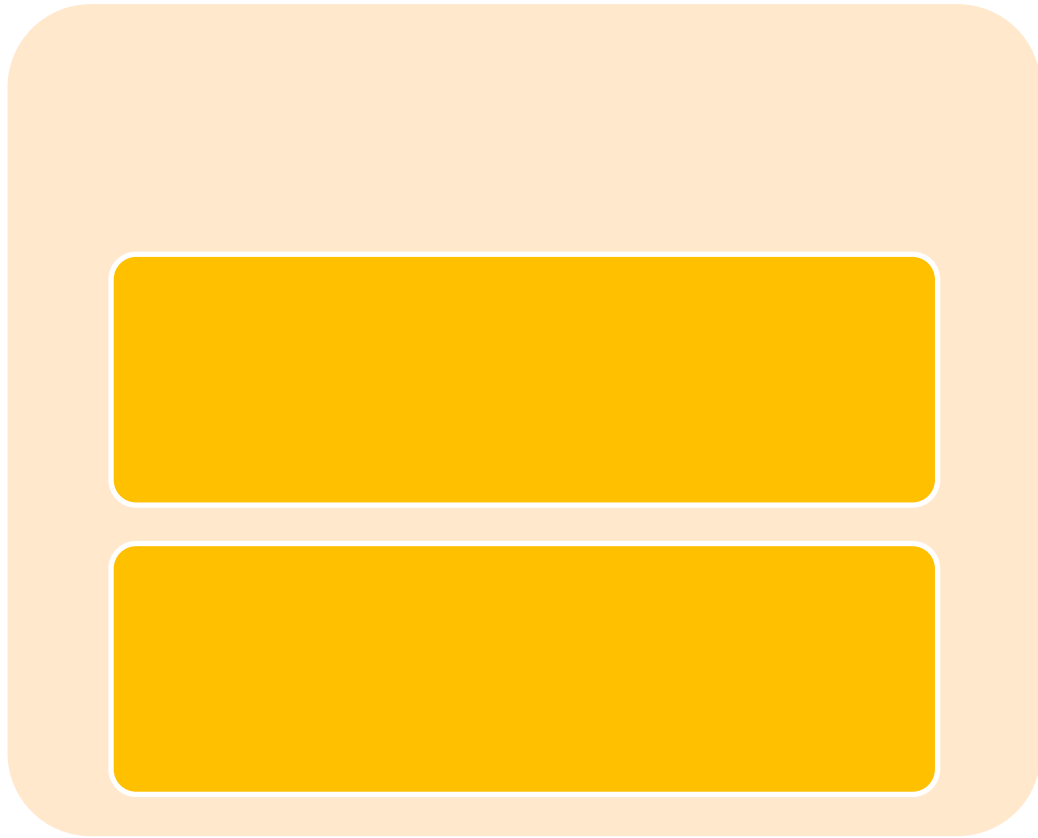


Diagram showing a light orange rounded rectangle containing two stacked yellow rounded rectangles, representing a task or project.



Ensures that you don't forget

Ensures users know you're working

you've done.



- When you've started working on a request
-
- When you're finished

-

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Week # 3

Server Operating Systems

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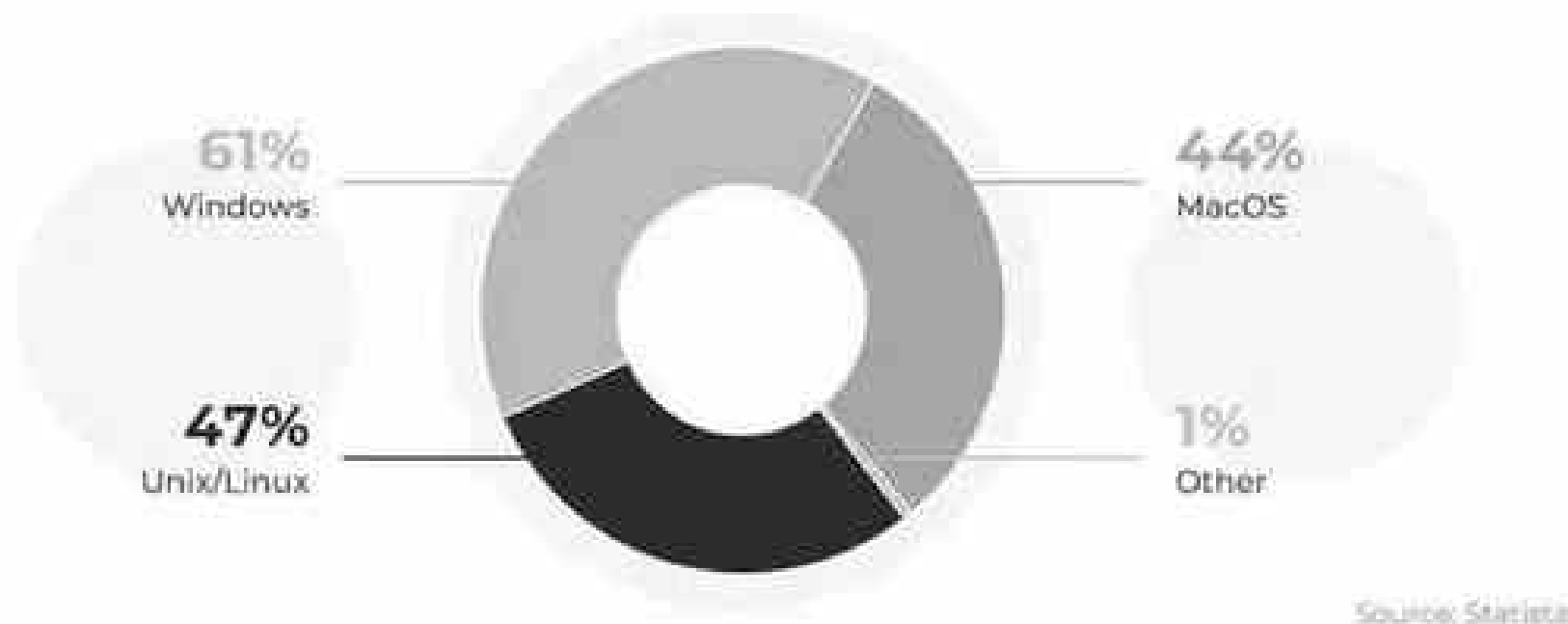




Primary Operating Systems Among Professional Developers



TRUELIST

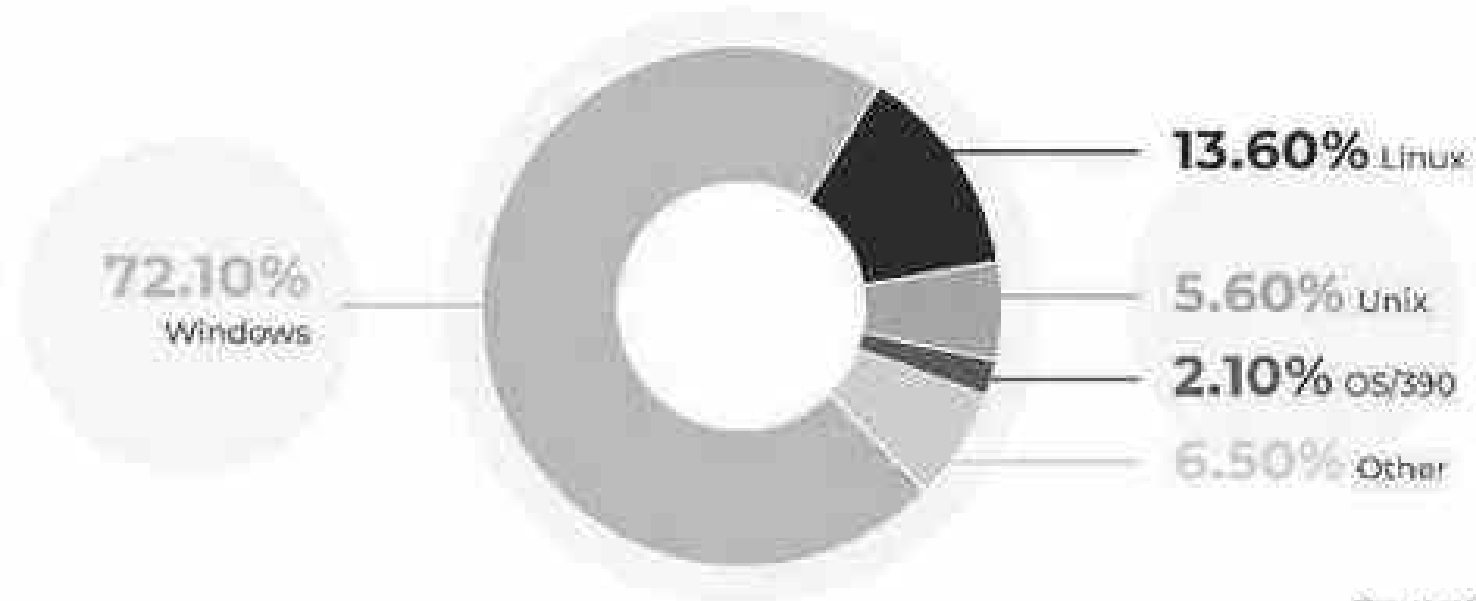




Server Market Share Worldwide by Operating System



TRUELIST



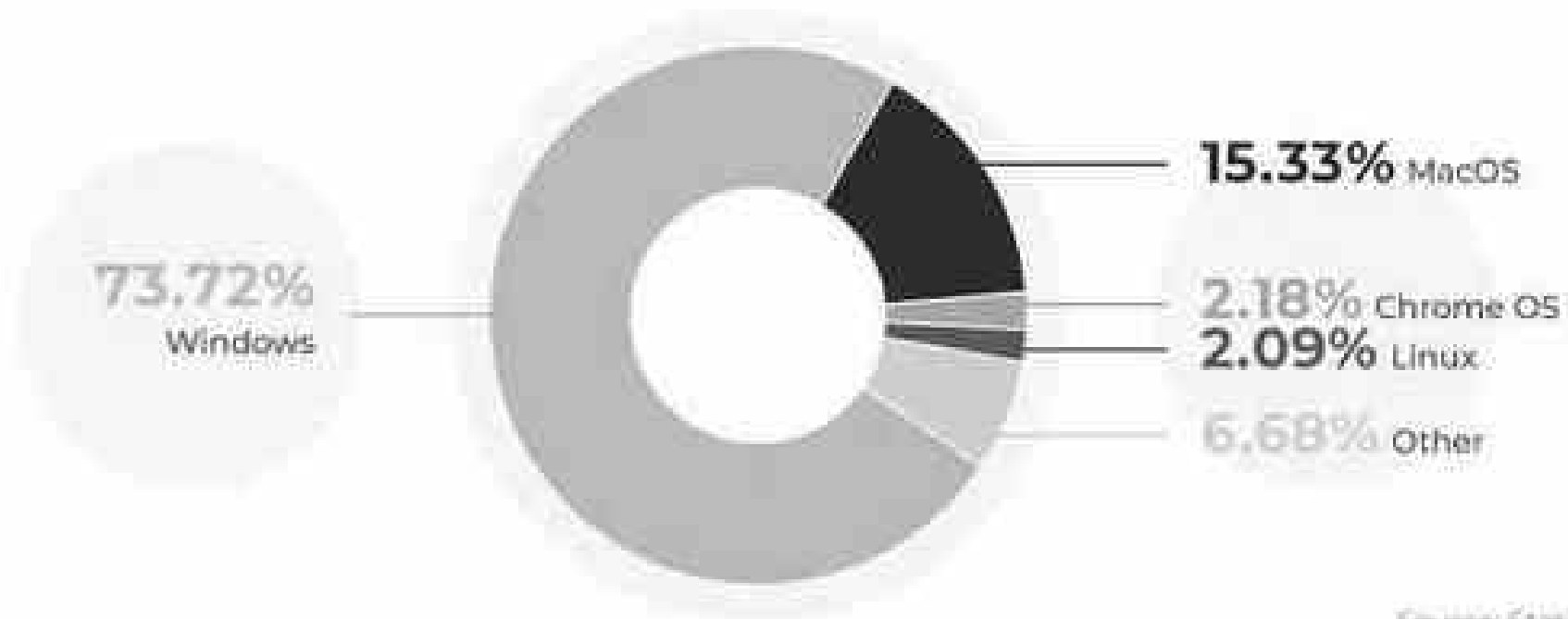
Source: Statista



Leading Desktop Operating Systems Worldwide by Market Share



TRUELIST



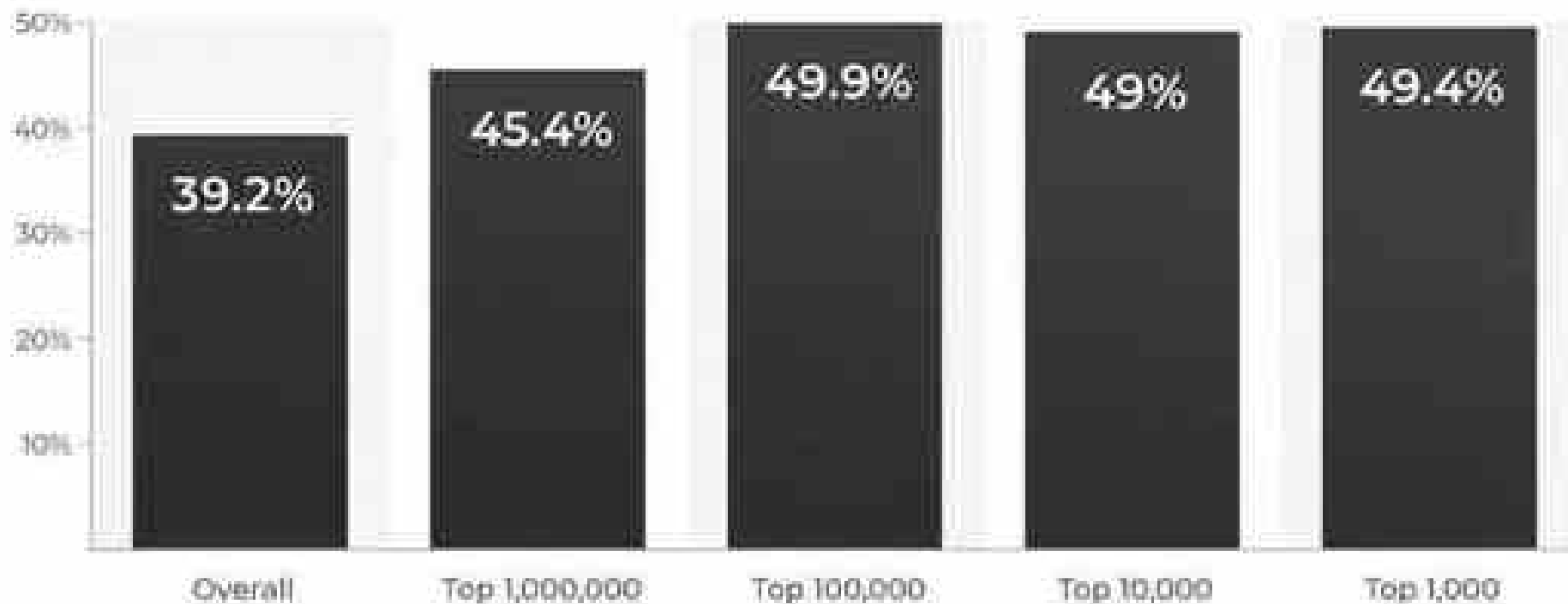
Source: Statista



Distribution of Linux-Powered Websites by Global Ranking



TRUELIST



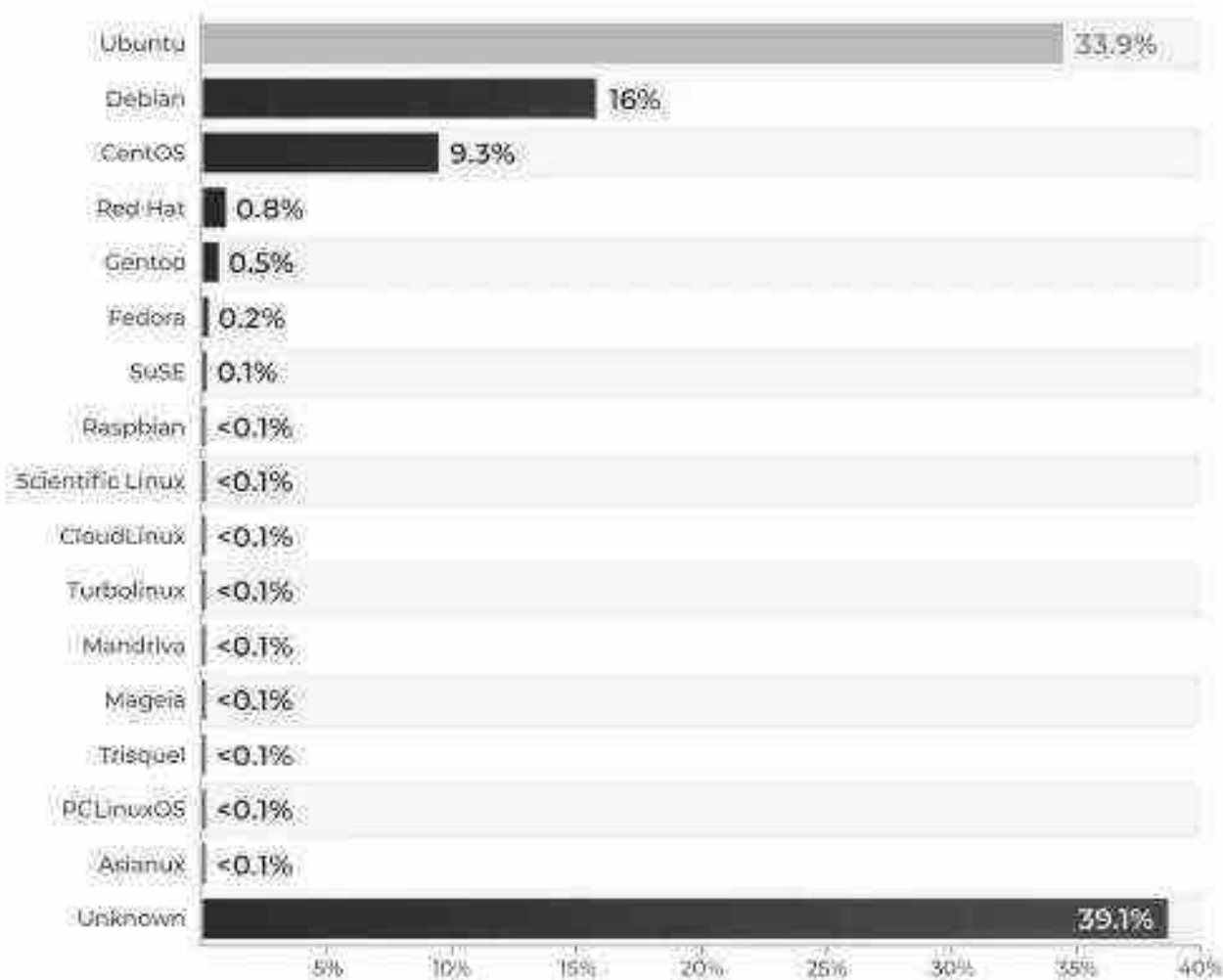
Source: W3Techs



Top Linux Subcategories by Market Share



TRUELIST



Source: W3Techs

OS



Architecture

Centered around
the Linux kernel

Cost

Free

open-source
software

Security

- Highly secure
against

Support

Large comm.
supports

Answer commonly
asked questions



- Based on the
Windows NT
architecture

- Owned by
Microsoft,
- a licensing fee
per user

- More prone to
 -
 -

- Community and
long-term
customer
support
- Great
documentation

OS

Operation

User Experience

**Database
Support**

Scripting Support



command line

**requires an
relatively
experienced Linux
administrator**

**MySQL,
PostgreSQL**

**Python
PHP,
Perl,
Other Unix
languages**



**graphical user
interface**

**more beginner-
friendly**

**Microsoft SQL
Microsoft Access**

**ASP
ASP.NET**

➤ Advantages

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- Supports cooperative work without exposing the program's core.

➤ Disadvantages

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➤ Advantages

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➤ Disadvantages

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Linux Server

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improve boot times. If you don't see the boot message and the "Welcome" screen which should appear

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[Redacted]

[Redacted]

[Redacted]

[Redacted]

⋮

[Redacted]

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[Redacted]

[Redacted] select "Done"

[Redacted]

[Redacted]

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Software Package Management

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➤ **Package management system is derived from the same system used by the Debian GNU/Linux Distribution.**

➤ **Package Files**

■

■

■

➤ **Dependencies**

■

■



■

- **dpkg is a package manager for Debian-based systems.**
- **It can install, remove, and build packages, but unlike other package management systems, it cannot automatically download and install packages or their dependencies.**
- **Using dpkg to manage software**
 - *dpkg -l*
 - *dpkg -l | grep apache2*
 - *dpkg -L ufw*
 -

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-

sudo dpkg -r zip

-

man dpkg

- **The apt command is a powerful command-line tool, which works with Ubuntu's Advanced Packaging Tool (APT) performing such functions as**

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- **Advantages**

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- **Installing a Package**

sudo apt install nmap

- **Removing a Package**

sudo apt remove nmap

- **Updating the Package Index**

sudo apt update

- **Upgrade Packages**

sudo apt upgrade

- **Actions of the apt command, such as installation and removal of packages, are logged in the /var/log/dpkg.log log file.**



sudo aptitude





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sudo aptitude install nmap
sudo aptitude remove nmap



sudo apt install unattended-upgrades







sudo apt install apticron



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ip a

```
sudo lshw -class network
```



➤ ethtool

-
-
-
-











```
nameserver 8.8.8.8  
nameserver 8.8.4.4
```









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