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# How to apply virtualization to Steel plants.

What is Virtualization

Introducing Virtualization

-World becoming Virtual: stores, tours, books, libraries...

-Computing: abstracting physical devices into logical objects.

-Replace a physical with a virtual environment for an application

-First time: Popek and Goldberg for IBM:

      Fidelity
      Isolation or Safety
      Performance

-WHY? Moore's law: Capacity doubles each 18 months.
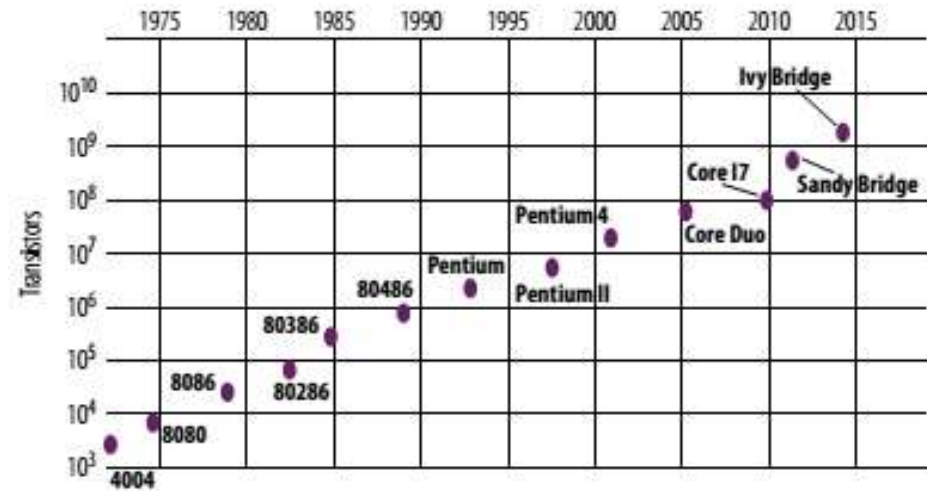
Moore's Law

Introducing Virtualization

-Process needs stay equal for long times

-Servers run at 15-10% of its capacity

-Servers consume 2% power produced in the country. Another 2% for cooling.

-One server-one application model.

Consolidation:

-Condense multiple physical servers into fewer servers running multiple virtual machines.

-Consolidation ratio: number of VMs in a server.

-Companies adopting virtualization-first policies.

Consolidation

File Servers   Print Servers   Email Servers   Database Servers   Web Servers

Virtualization Host
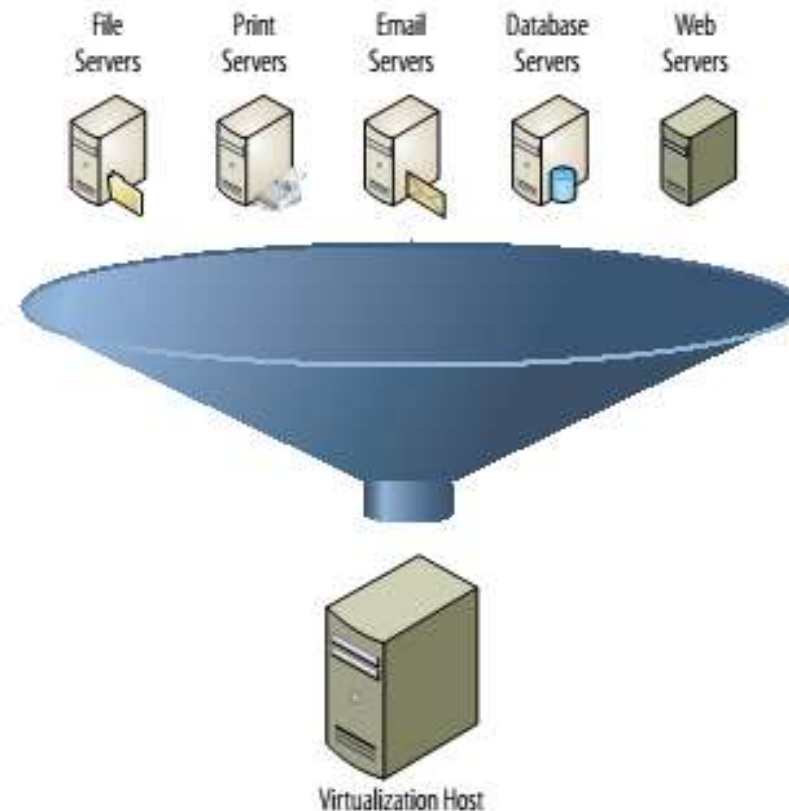
Increasing efficiencies

-Improving efficiency required for competitiveness: eliminate downtime.

-Reducing lifecycles of components reduce lifecycle of control systems.

-Functionality and maintenance cost to be ensured.

-**Virtualization offers costs savings, efficient usage, simplified management, easy upgrades and overall, guarantees system uptime.**
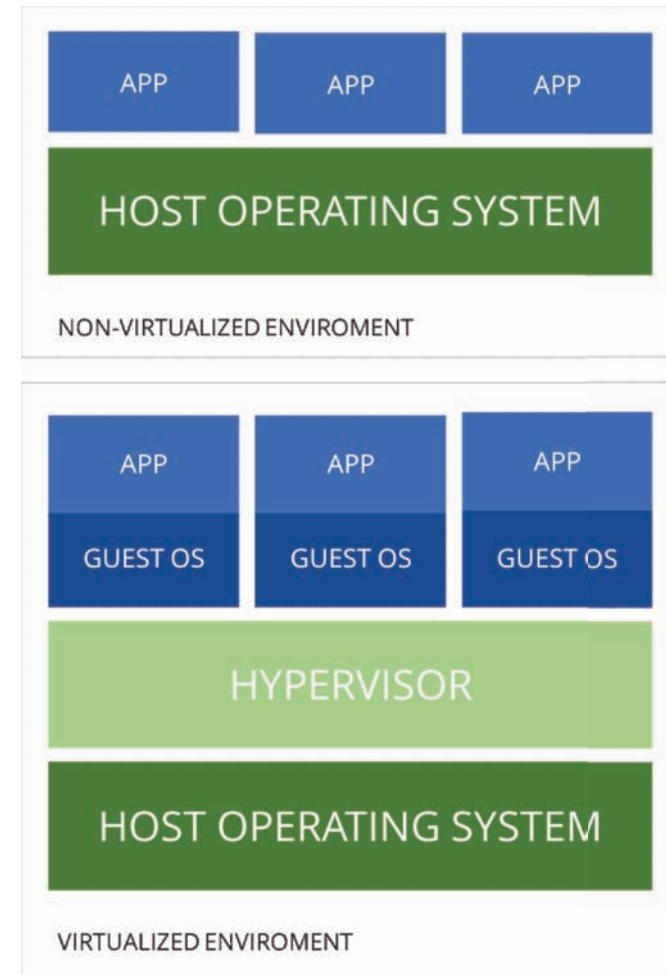
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Virtualization

-One physical server running many virtual servers.

-Each virtual server acts as an isolated, independent computer.

-Virtualization adds HYPERVISOR layer

-Hypervisor distributes physical resources among guest computers.

-Hardware resources utilization vastly increased.

Types of Virtualization

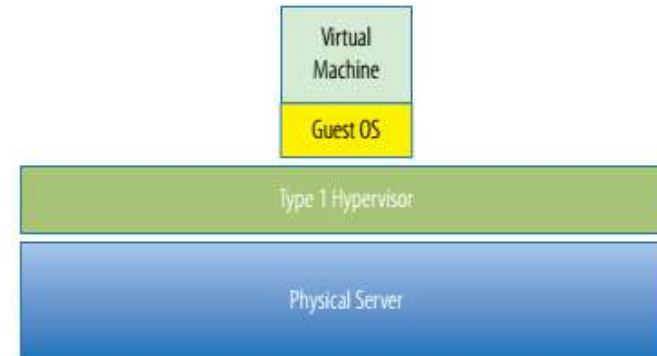# Hypervisors

Type 1

Bare Metal

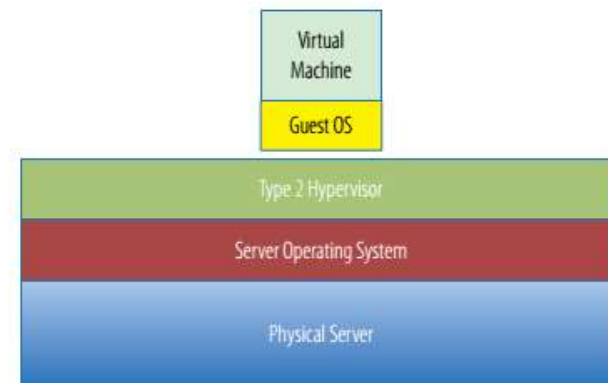- Hypervisor runs directly on physical hardware, direct communication with physical resources.

Type 2

Host OS

- Hypervisor runs on host operating system, requiring extra 2 interfacing steps for each HW resource demand.
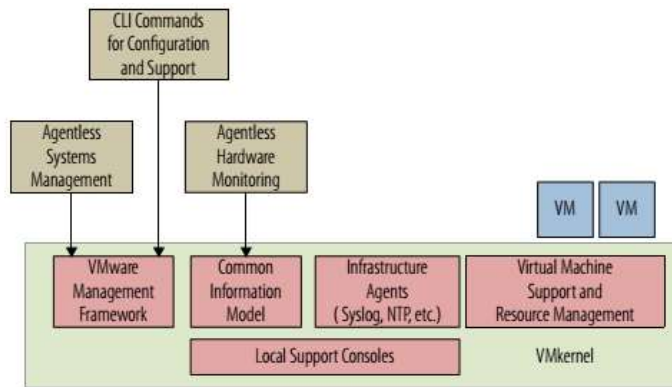
Type 1 Hypervisor

Virtual Machine
Guest OS

Type 1 Hypervisor

Physical Server

Type 2 Hypervisor

Virtual Machine
Guest OS

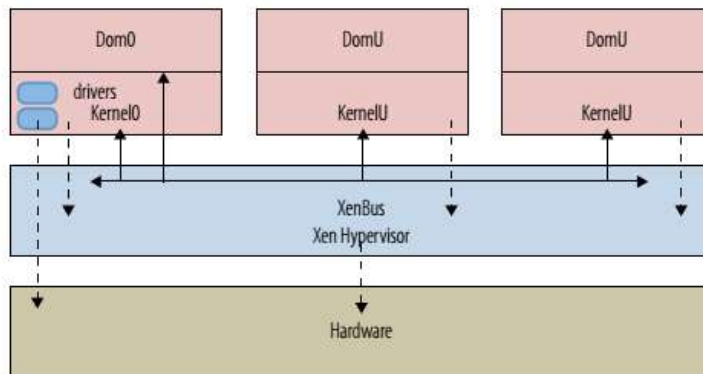| Type 2 Hypervisor |
|---|
| Server Operating System |

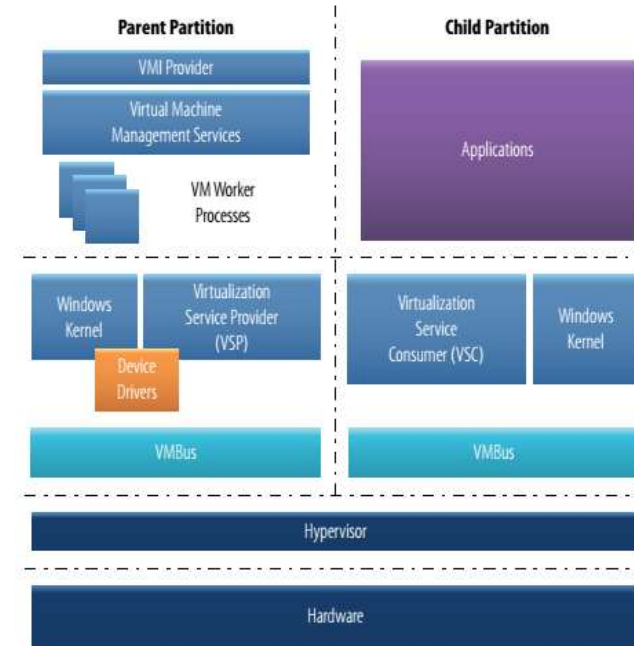| Physical Server |
|---|

TODAY HYPERVISORS

— VMWare ESX

— Citrix Xen

— Microsoft Hyper-V

— Other:

- Oracle VM
- Red Hat KVM
- etc

Why Virtualize?

Why virtualize

Save energy and space

Increase uptime

Isolate the possible problems

Extend the life of the applications

Avoid the hardware vendor lock-in and make the upgrades simpler
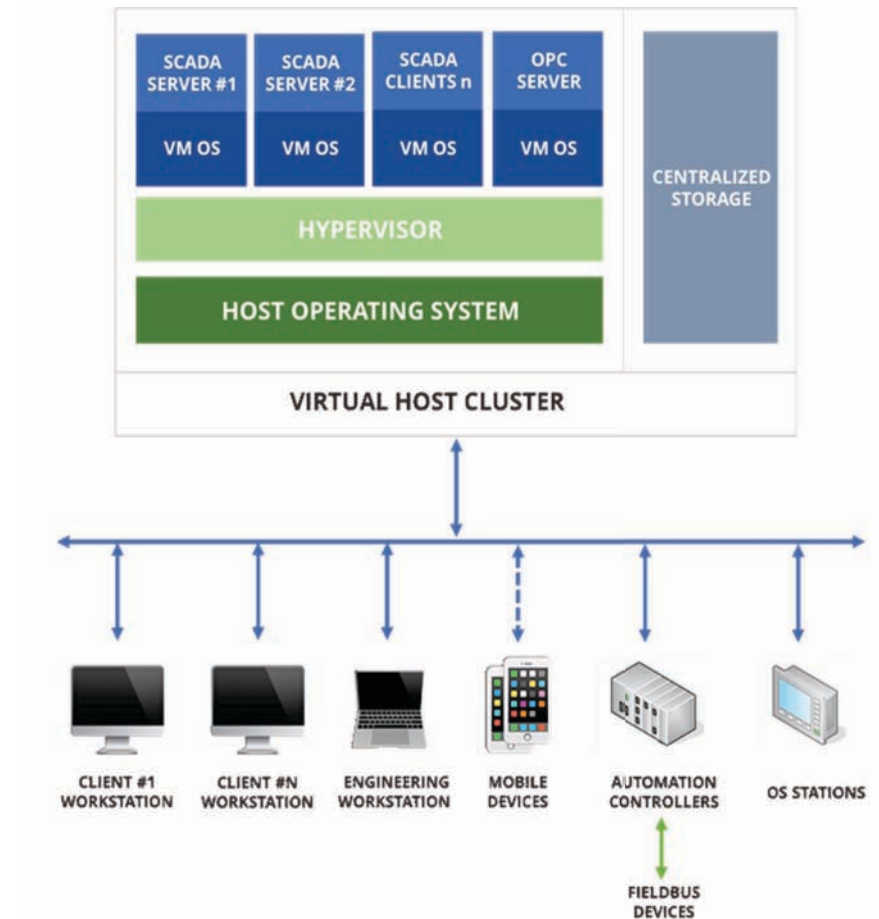
Create test environments

Application cases

Server virtualized infrastructure

-Physical redundant servers host virualized plant computer architecture.

-Server runs hypervisor and hosts HMI server and clients.

-Engeneering tools fit in same server

-Thin clients remotely run virtualized clients.

Server virtualized infrastructure
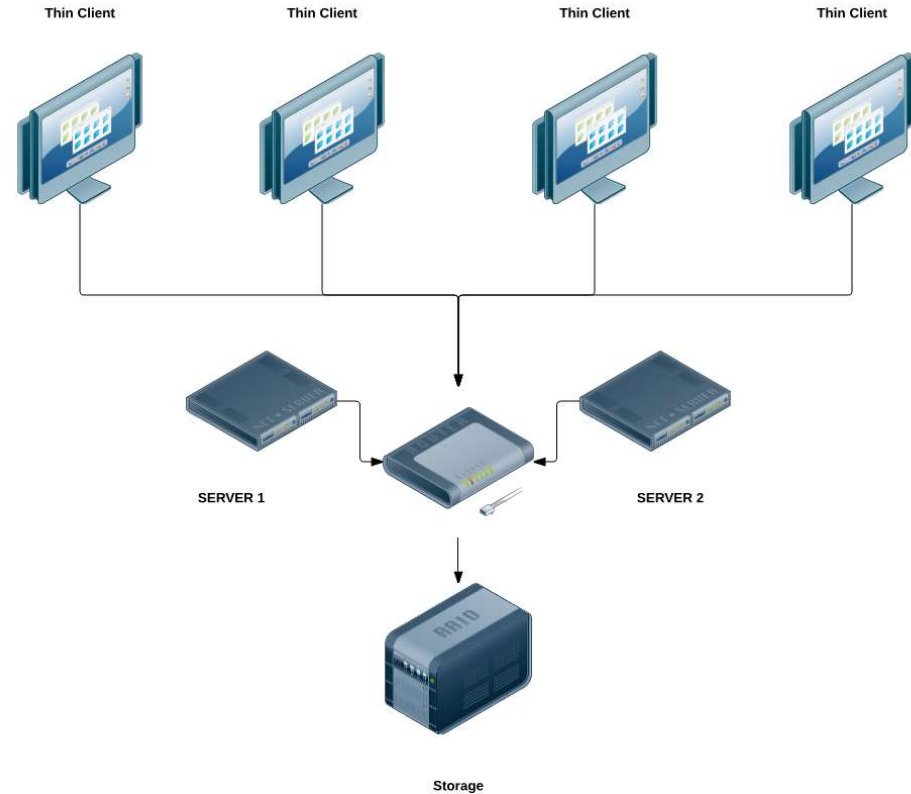
Russula approach

-Redundant type 1 hypervisor servers.

-Redundant HD cabin (DELL, HP, IBM...)

-Thin Client Access software managed (Vmware Horizon, Citrix...), pulpit oriented.

-Several implementations for Nucor, Arcelor Mittal,

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Server virtualized infrastructure

PROS

-Fewer servers consuming less energy and space.

-Easy maintenance and management: recovery points, load balance and hot swapping of failed hardware.

-Higher uptime and faster disaster recovery.

-Simplifies application isolation

-Guarantees future hardware migration.

-Extend application life.

CONS

-Magnified hardware failures

-High upfront investment that will be recovered in the long-run.

-New management tools and new skills for managing the virtualized environment.

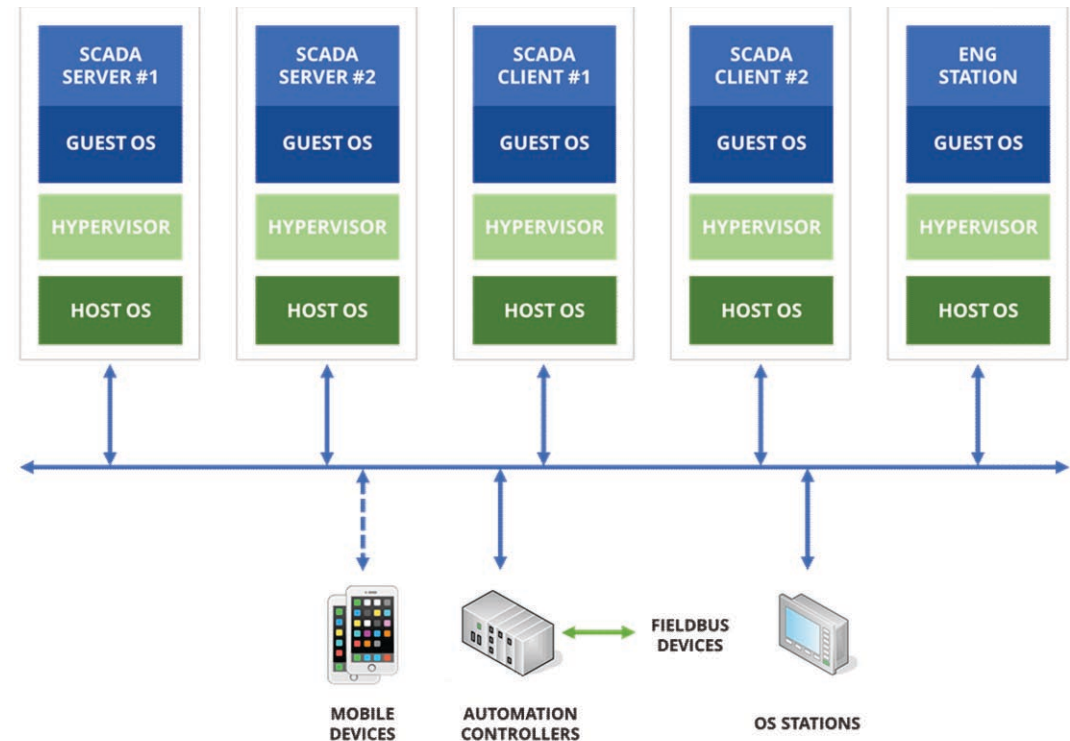-Unnecessary virtual machines sprawl due to the simplicity of deploying new instances.

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Computer-by-computer approach

-Provides solution to supoprt legacy systems

-Extends control system life

-Virtualization of legacy system allows it to run in modern HW.

-Allows future addition of other systems in the plant as they get outdated.
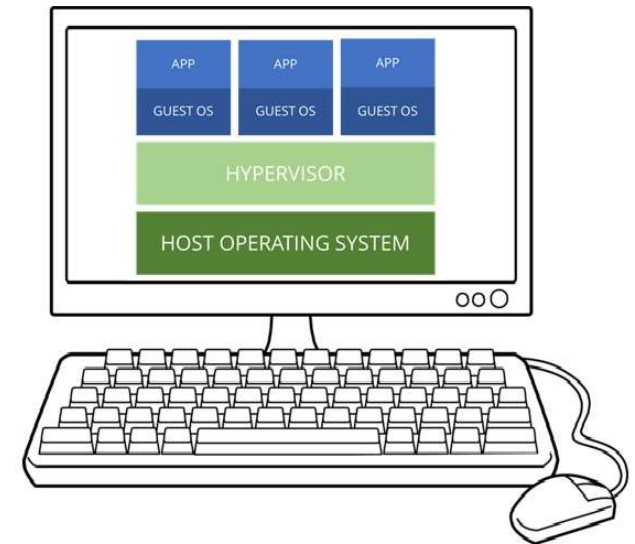
Computer-by-computer approach

Russula approach

-Server running type 1 or 2 hypervisor.

-Size according to future upgrades of existing equipment in plant.

-Implementations in dozens of Steel plants running legacy equipment.

Computer-by-computer approach

PROS

-Low cost solution

-Simplifies the isolation of the applications

-Guarantees the future hardware migration

-Extend application life

CONS

-Missing advantages of a server virtualized environment.

-Not a fault tolerance solution.

Conclussions

— Virtualization has been used in corporate environments and developers. Now in industrial enviroments.

— As a developer that has been using virtualization along time RUSSULA has the experince and skills to both develop virtualized industrial systems and virtualization of existing ones.

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Thank you!

Credits to:
Matthew Portnoy, Virtualization Essentials.
Daniel Sánchez, Virtualization for Manufacturing Industries.