



# AUTOMATION, ORCHESTRATION, MONITORING

**David López**  
**(i Josep Ll. Berral)**  
**V.1.1**  
**Spring 2025**



**UNIVERSITAT POLITÈCNICA  
DE CATALUNYA  
BARCELONATECH**

## Remember?

General organizations:

**1.- Governance**

**2.- Management**

**3.- Execution**

## Remember?

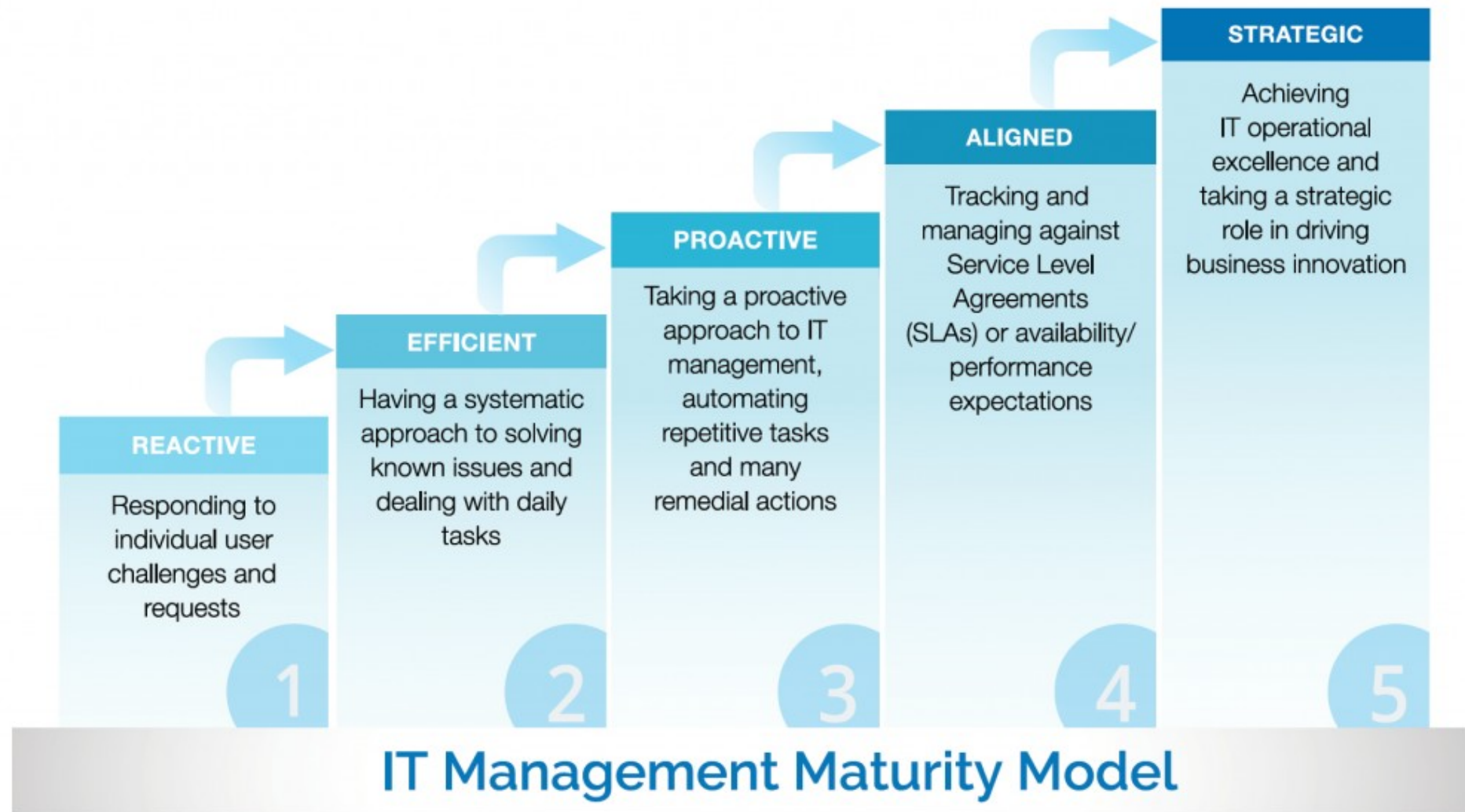
General organizations:

**1.- Governance**

**2.- Management**

**3.- Execution**

What are the goals?  
What do we need?

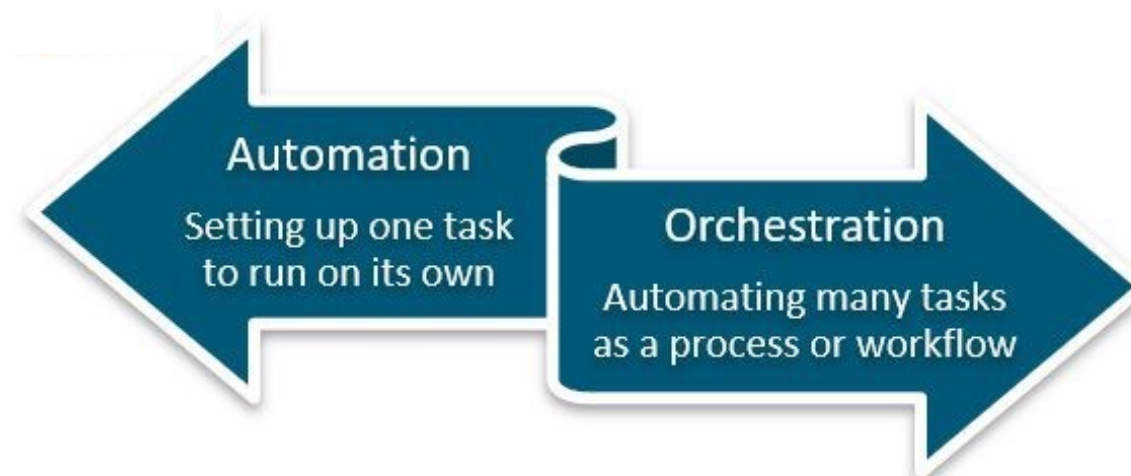


### Automation

- Take common tasks and script them so that they can be done, for example, with a single command
- Examples: creating a new virtual machine; launching a web service; stopping a service; organizing emails in folders
- This is about automating **tasks**

### Orchestration

- Works at a higher level
- Example: deploying an application with a Web server, a middleware server and a database server, analyzing workload of physical servers and move virtual machines
- This is about automating **processes**





Imperative

```
apt install libreoffice
```



Declarative

```
package { 'libreoffice':  
    ensure => 'latest',  
}
```

# A server

You buy it – Name it – Install an OS – Install software – Configure it – Actualize software – Change configuration – Install new software – Actualize OS – Change configuration- Update OS – Install more and more things – Upgrade hardware – Love it – Maintain it with great effort

What if you have 1000 servers?

# A ~~server~~ pet

You buy it – Name it – Install an OS – Install software – Configure it – Actualize software – Change configuration – Install new software – Actualize OS – Change configuration- Update OS – Install more and more things – Upgrade hardware – Love it – Maintain it with great effort





# From PETS to HERDS



# From PETS to HERDS

1.- Buy homogenous servers with IPMI/Redfish

-The Intelligent Platform Management Interface (IPMI) is a set of computer interface specifications for an autonomous computer subsystem (BMC – Baseboard Management Controller) that provides management and monitoring capabilities independently of the host system's CPU, firmware (BIOS) and operating system. in 2014 evolved to Redfish.





# From PETS to HERDS

- 1.- Buy homogenous servers with IPMI/Redfish
- 2.- Service must be independent from hardware
- 3.- Practical names for servers but also easy to remember



# From PETS to HERDS

- 1.- Buy homogenous servers with IPMI/Redfish
- 2.- Service must be independent from hardware
- 3.- Practical names for servers but also easy to remember
- 4.- Joint management (group in herds)
- 5.- Use tools (herding dogs)



# From PETS to HERDS

- 1.- Buy homogenous servers with IPMI/Redfish
- 2.- Service must be independent from hardware
- 3.- Practical names for servers but also easy to remember
- 4.- Joint management (group in herds)
- 5.- Use tools (herding dogs)
- 6.- Document / codify configuration (IaaC)

Infrastructure as a Code (IaaC) refers to the delivery and management of infrastructure through high-level descriptive code compared to manual processes.



### An example: the TSC department at UPC

#### Foreman

- Graphic interface that can work with other tools
- Group servers in hostgroups
- A new server is installed: foreman detects it
- You identify the hostgroup the new server belongs to
- Other tools organize the new server

#### Cobbler

- OS installation

#### Puppet

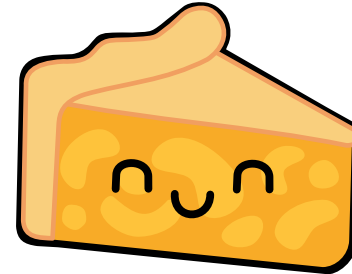
- Software installation
- It is DECLARATIVE

#### Ansible

- For punctual tasks
- For instance, some shutdowns



FOREMAN

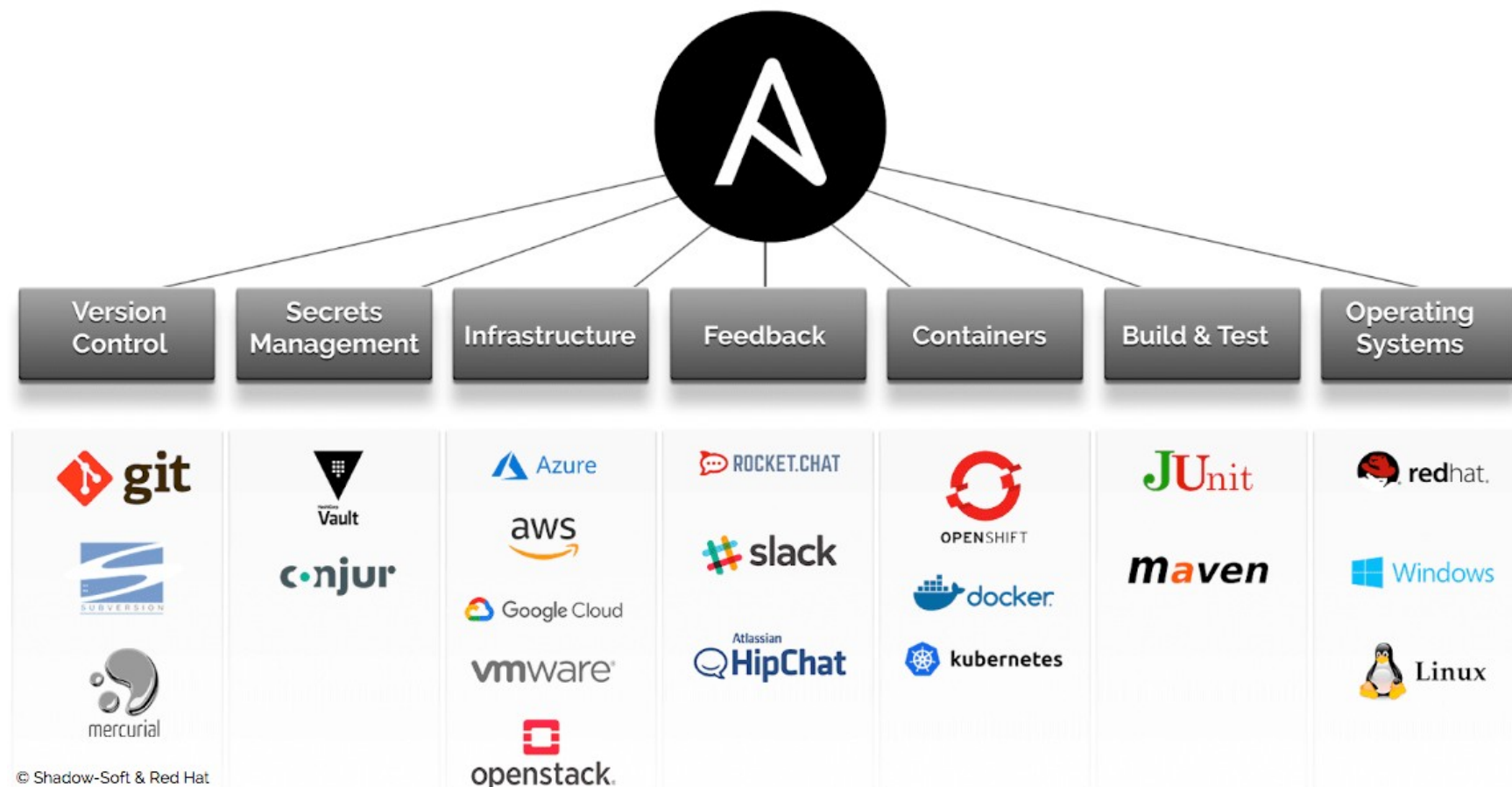


puppet



ANSIBLE





## Automation in developing

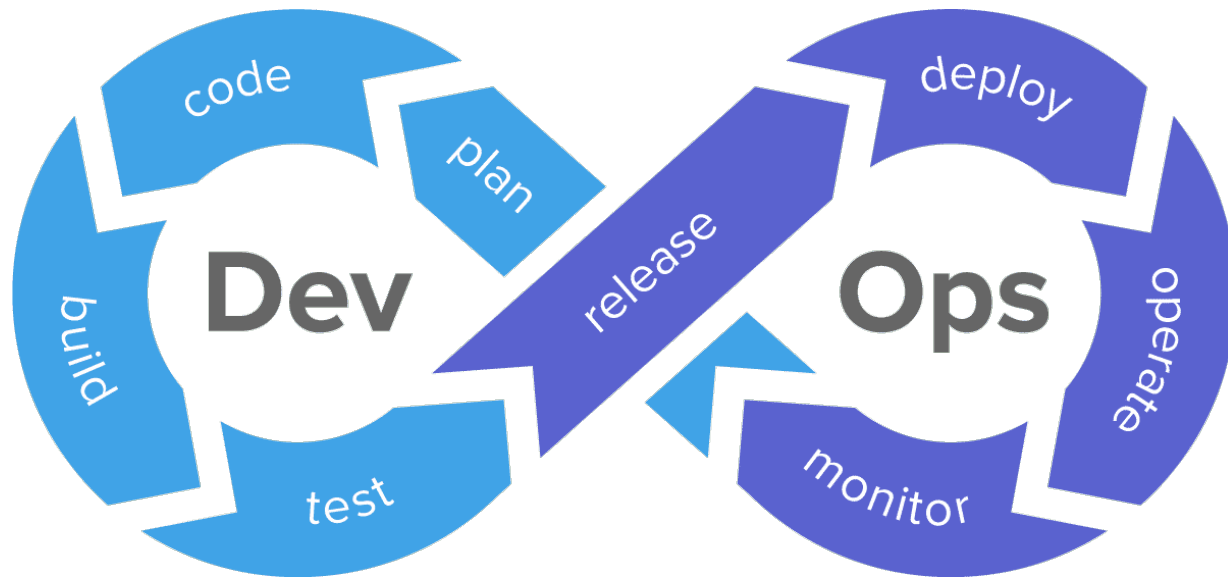
- 1.- Code repository (e.g. Git, CVS, Vault)
- 2.- Building automated tools (e.g. PVS-Studio, Crucible, sonarqube)
- 3.- Automatic integration (e.g. Jenkins, Tekton Pipelines)



# Jenkins





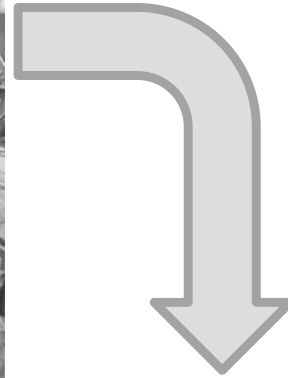


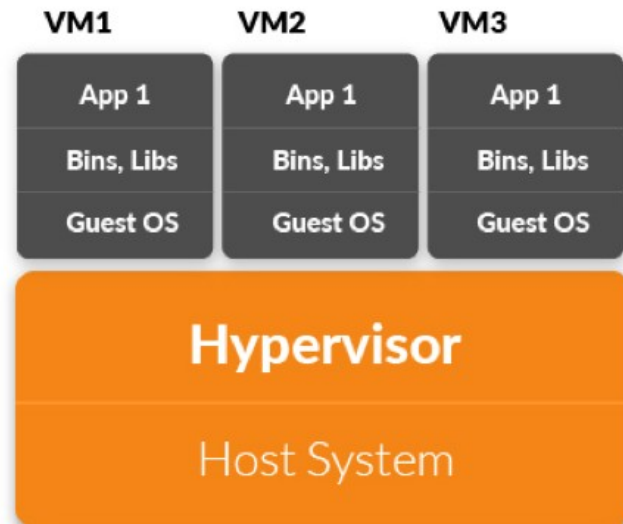
- Plan: something new, some new feature, fixing some problem...
- Code: following patterns
- Build: creating a new version (in a sandbox)
- Test: does it works? strong test system
- Release: new version (beta) for some users or working in parallel with old version
- Deploy: new version available for all clients
- Operate: working in normal basis
- Monitor: QoS, client response, ...

Greg Lavender, CTO Intel  
The Phoenix Project (book)

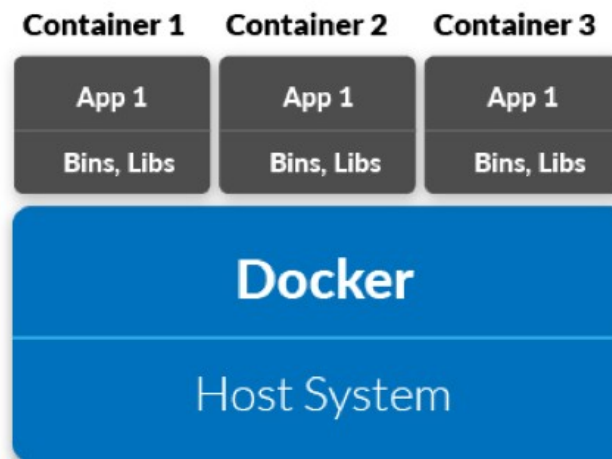
Company	Deployment frequency
Amazon	23,000 per day
Google	5,500 per day
Netflix	500 per day
Facebook	1 per day
Twitter	3 per week
Typical enterprise	1 every 9 months

## Containers





Traditional Hypervisor



A Docker Host

### Monitoring:

- You need good, trustful and up-to-date information to take decisions
- Different tools

## Monitoring:

- You need good, trustful and up-to-date information to take decisions
- Different tools: Nagios

**Nagios®**

**Current Network Status**  
 Last Updated: Fri Oct 17 18:51:18 UTC 2014  
 Updated every 90 seconds  
 Nagios® Core™ 4.0.8 - www.nagios.org  
 Logged in as nagiosadmin

**Host Status Totals**

Up	Down	Unreachable	Pending
11	0	0	0

**Service Status Totals**

Ok	Warning	Unknown	Critical	Pending
33	1	1	4	0

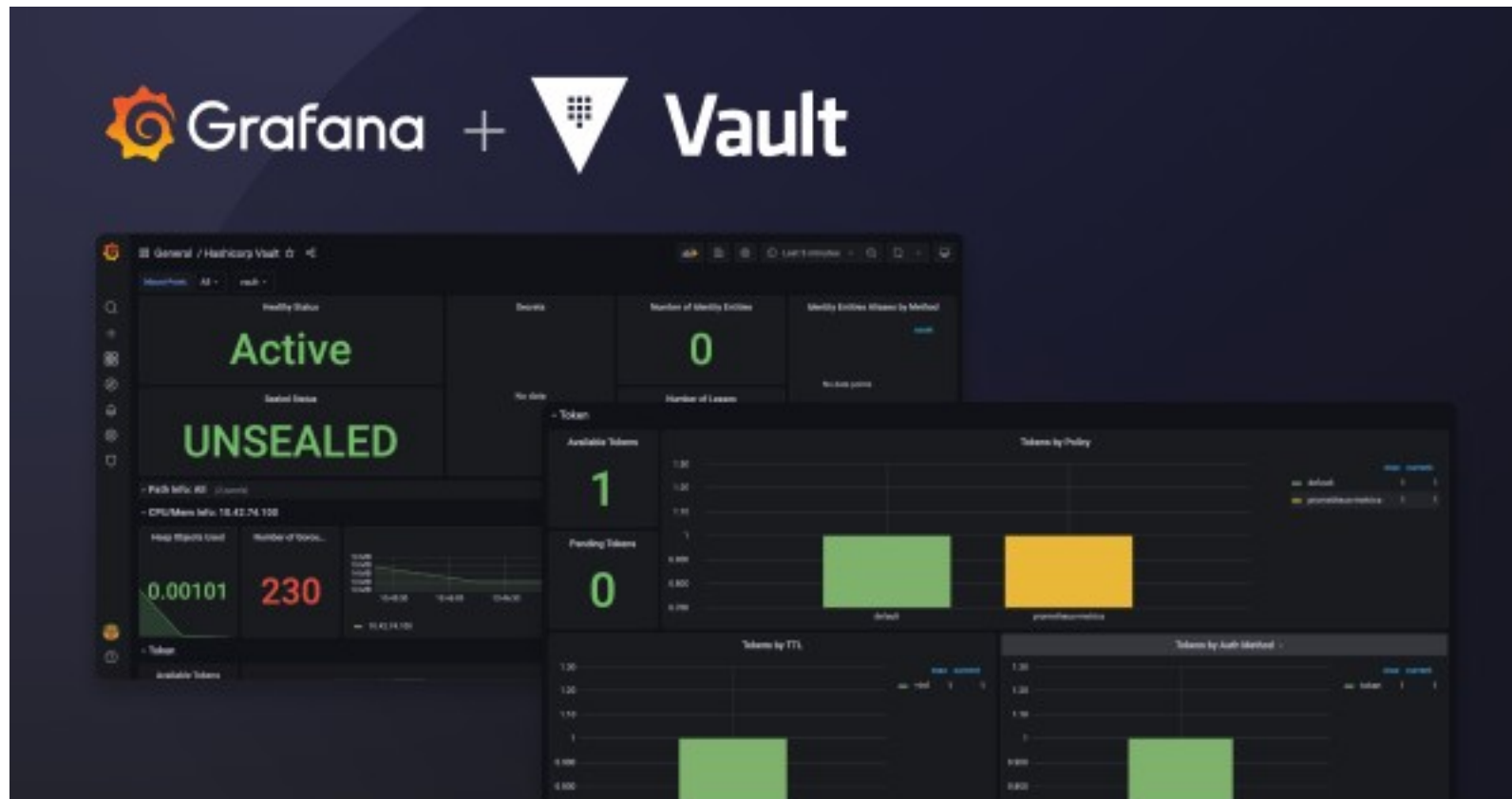
**Service Status Details For All Hosts**

Limit Results: 100

Host	Service	Status	Last Check	Duration	Attempt	Status Information
NOAA	Auroral Activity	OK	10-17-2014 18:51:09	535d 4h 28m 6s	1/3	Aurora OK: Activity level is 2
	Weather Carteret North Carolina	WARNING	10-17-2014 18:43:15	0d 0h 46m 57s	3/3	Weather Warning: Beach Hazards
	Weather King Washington	OK	10-17-2014 18:45:25	737d 1h 52m 46s	1/3	Weather OK: No watches or warni area.
	Weather Ramsey Minnesota	OK	10-17-2014 18:46:45	59d 20h 47m 12s	1/3	Weather OK: No watches or warni area.
	Weather San Bernardino California	OK	10-17-2014 18:41:45	0d 0h 48m 40s	1/3	Weather OK: No watches or warni area.
	Weather Strafford New Hampshire	OK	10-17-2014 18:43:45	0d 0h 46m 51s	1/3	Weather OK: No watches or warni area.
	Weather Tulsa Oklahoma	OK	10-17-2014 18:45:53	737d 1h 53m 51s	1/3	Weather OK: No watches or warni area.
	Current Load	OK	10-17-2014 18:49:08	0d 0h 46m 9s	1/4	OK - load average: 0.29, 0.49, 0.56
localhost	Current Users	OK	10-17-2014 18:51:02	1710d 15h 36m 24s	1/4	USERS OK - 0 users currently logg
	HTTP	OK	10-17-2014 18:48:25	1019d 2h 7m 58s	1/4	HTTP OK: HTTP/1.1 200 OK - 218 response time
	PING	OK	10-17-2014 18:50:20	1710d 15h 35m 9s	1/4	PING OK - Packet loss = 0%, RTA
	Root Partition	OK	10-17-2014 18:48:32	938d 2h 32m 35s	1/4	DISK OK - free space: / 20300 MB
	SSH	OK	10-17-2014 18:46:38	1704d 7h 35m 15s	1/4	SSH OK - OpenSSH_4.3 (protocol
	Swap Usage	OK	10-17-2014 18:48:54	1710d 15h 33m 17s	1/4	SWAP OK - 100% free (255 MB ou
	Total Processes	OK	10-17-2014 18:50:49	1706d 8h 22m 2s	1/4	PROCS OK: 147 processes with S

### Monitoring:

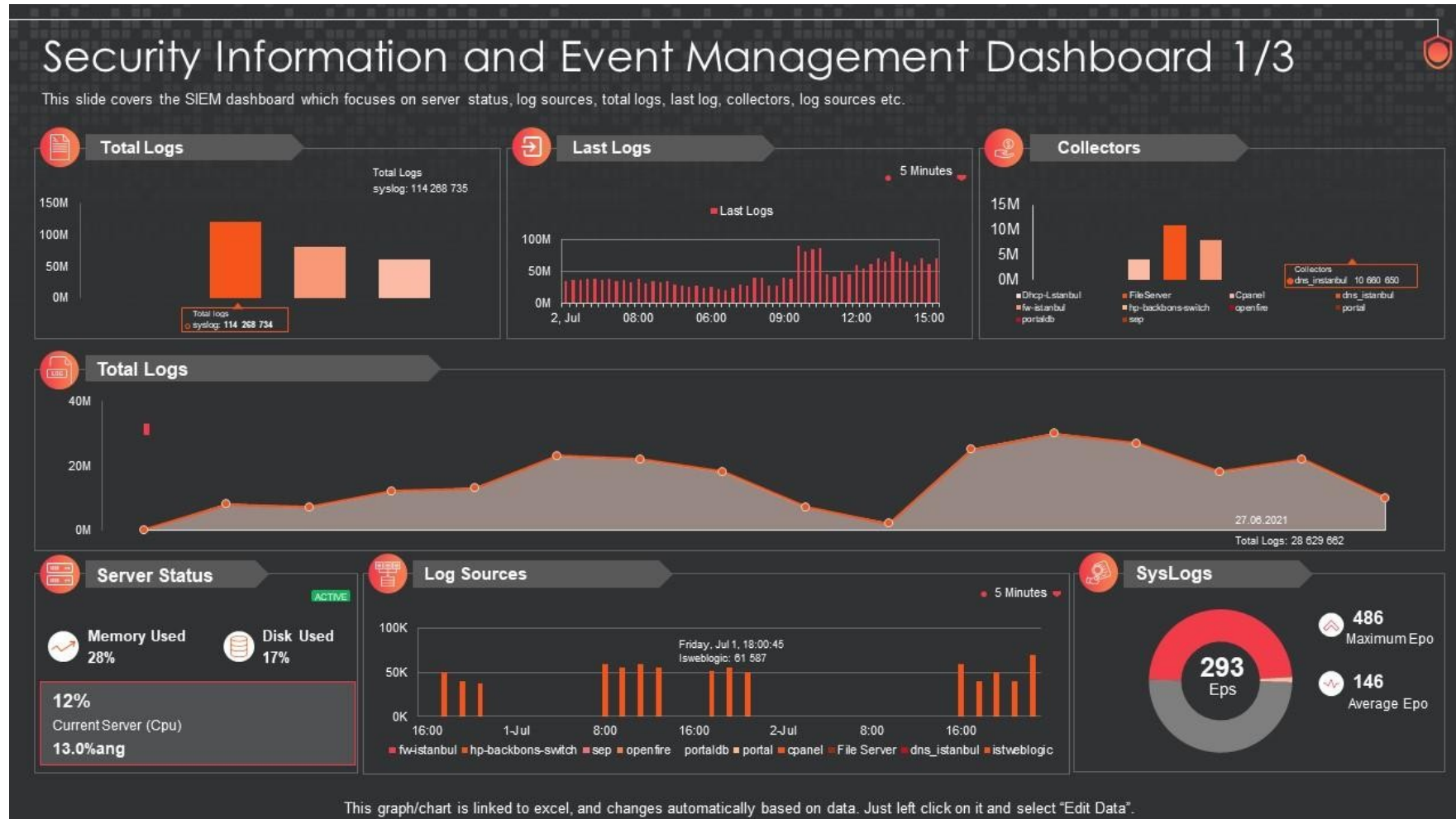
- You need good, trustful and up-to-date information to take decisions
- Different tools (Grafana + Vault)





### Monitoring:

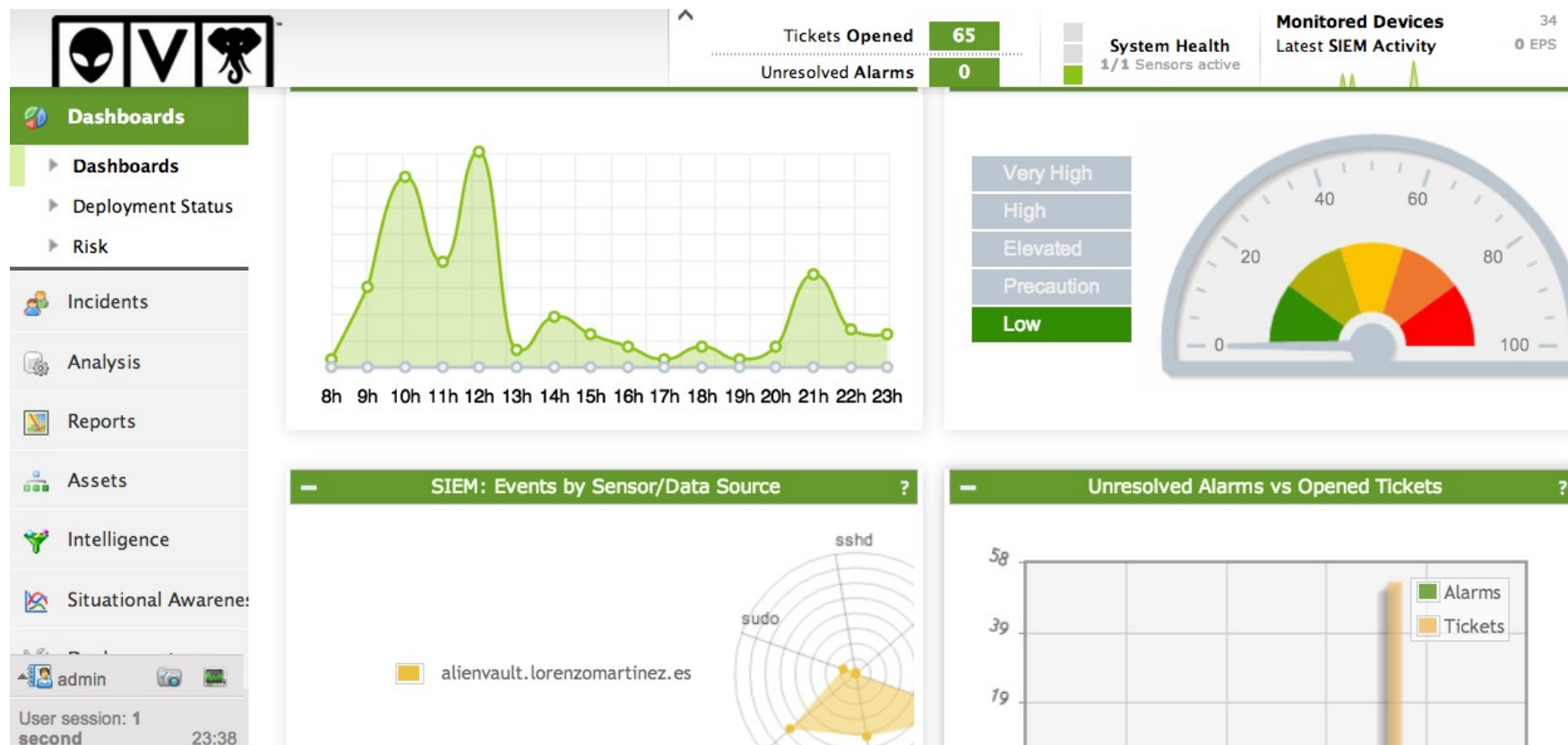
- You need good, trustful and up-to-date information to take decisions
- Different tools (SIEM – a lot of software)





### Monitoring:

- You need good, trustful and up-to-date information to take decisions
- Different tools: AlienVault/ OSSIM



**KPI (Key Performance Indicators)**: in IT they are indicators of how are we achieving our goals

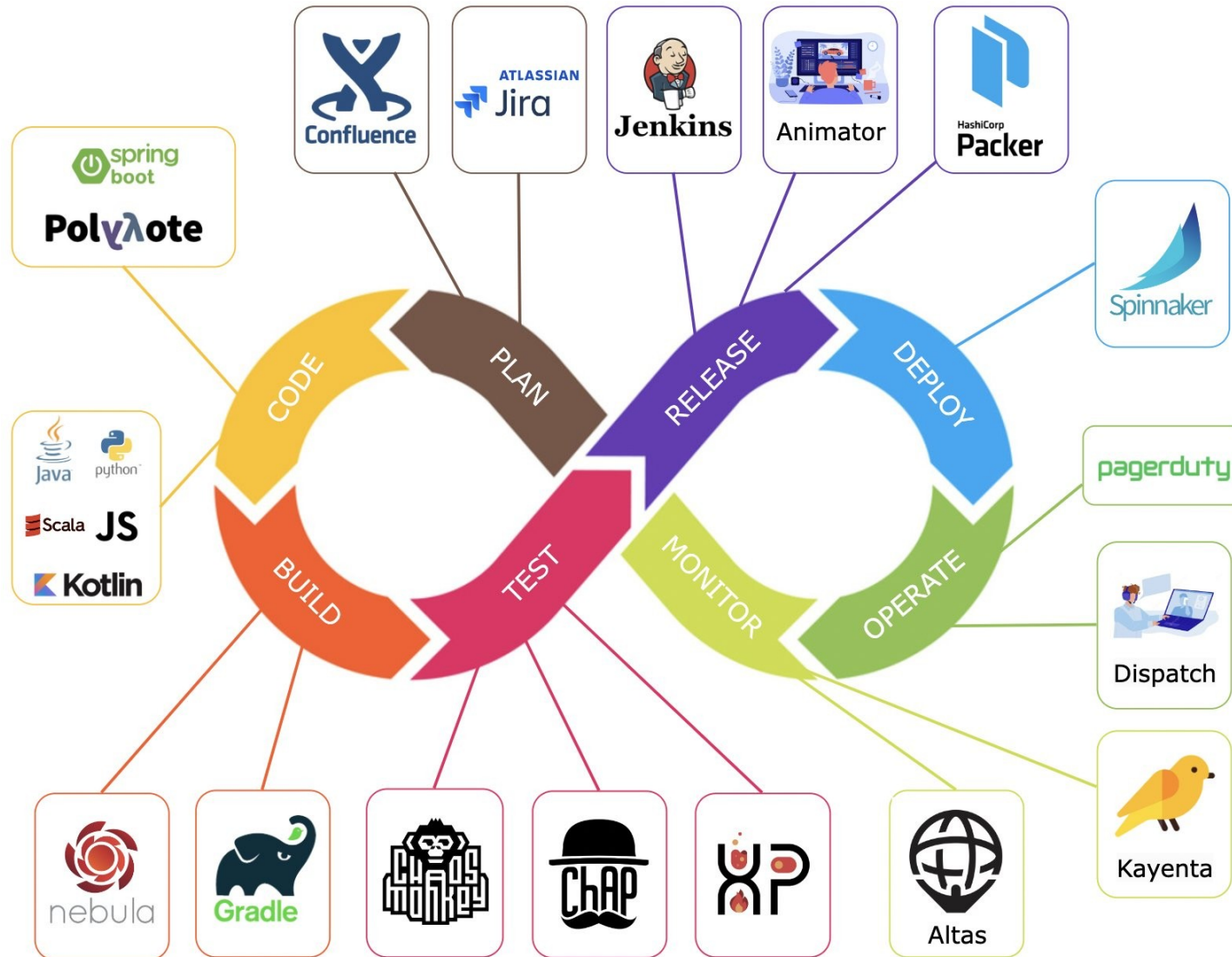
- Quality of Service (QoS) – user's experience
- Operation
- Crisis Management
- Security

### Some examples (monitoring to control KPIs)

- Free storage available
- Storage access
- Real IOPS / time to read/ write a data
- VM information (number, physical server ...)
- Physical servers workload / performance
- CPU/ Memory utilization
- Network load
- Communication time between servers
- Power usage (%)
- Humidity
- Temperature of servers/ racks
- Cooling consumption
- Storage servers real workload
- Change Requests per user, stage and type
- PUE
- Traffic patterns
- Data Center Optimization Initiative (DCOI) Compliance
- Cost per customer
- Deployment trends
- Anomaly detection
- Availability of host and services
- Net services (http, SMTP,... with safety probes)

# NETFLIX Tech Stack (CI/CD Pipeline)

 [blog.bytebytego.com](https://blog.bytebytego.com)





# AUTOMATIZATION, ORCHESTRATION, MONITORING

**David López**  
**(i Josep Ll. Berral)**



UNIVERSITAT POLITÈCNICA  
DE CATALUNYA  
BARCELONATECH