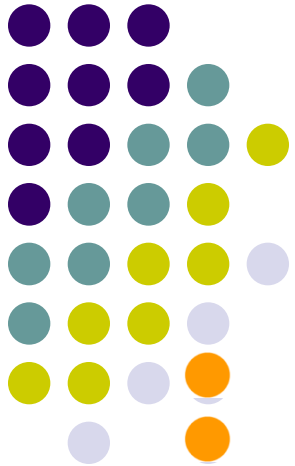
Arquitetura de Software

Multiprocessamento

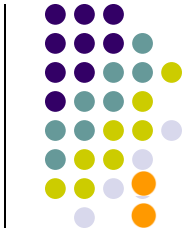
Interrupção, Virtualização e Containerização

José Motta Lopes

josemotta@bampli.com

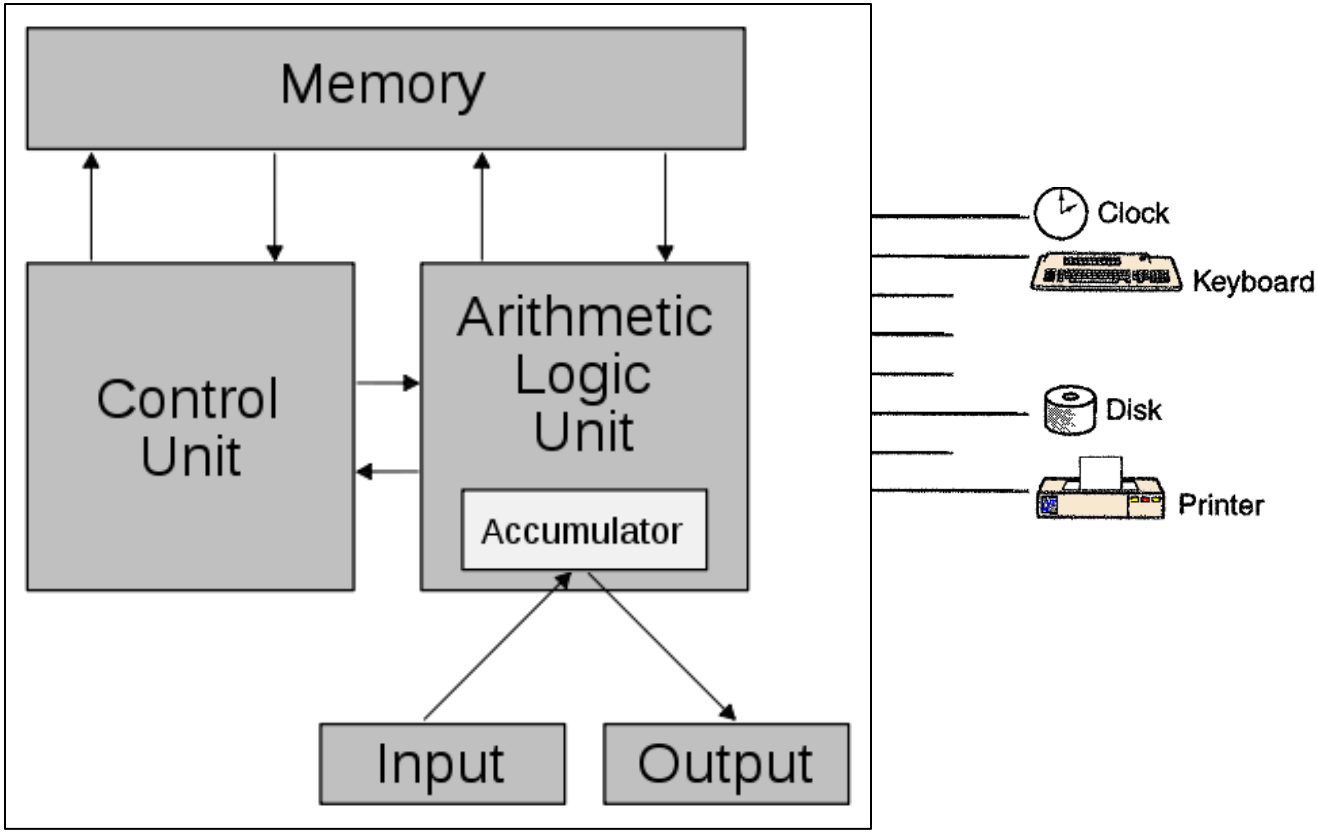


Agenda

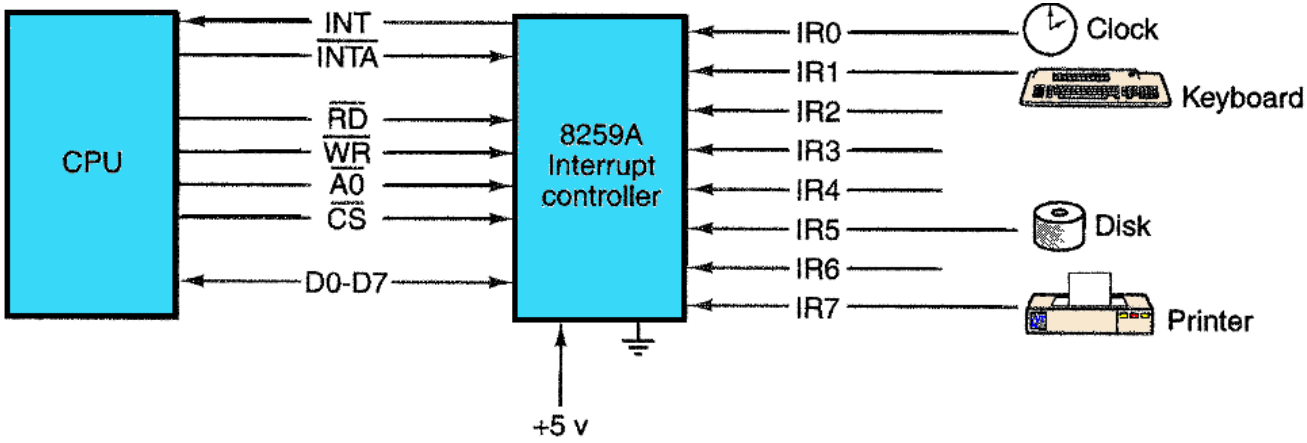


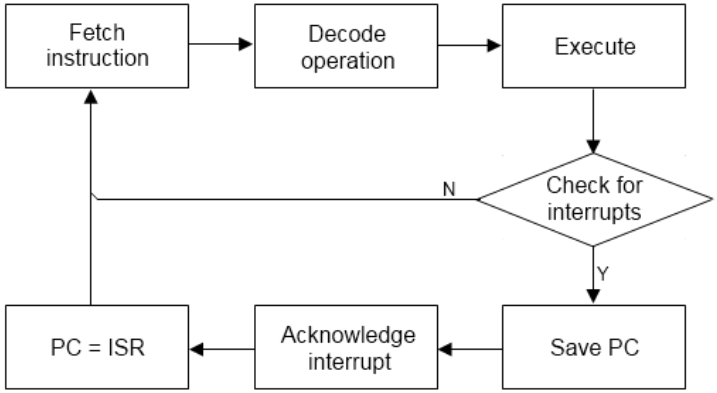
- CPU von Neumann
- Interrupção
- Multiprocessamento
- Virtualização
- Containerização
- Docker
- Arquitetura Docker
- Vantagens Docker
- Dockerfile
- Demo Docker-Python
- Projeto IoT: Estação do Clima
- Workflow P&D Software
- Estação Remota
- Estação Usuário

CPU von Neumann



Interrupção

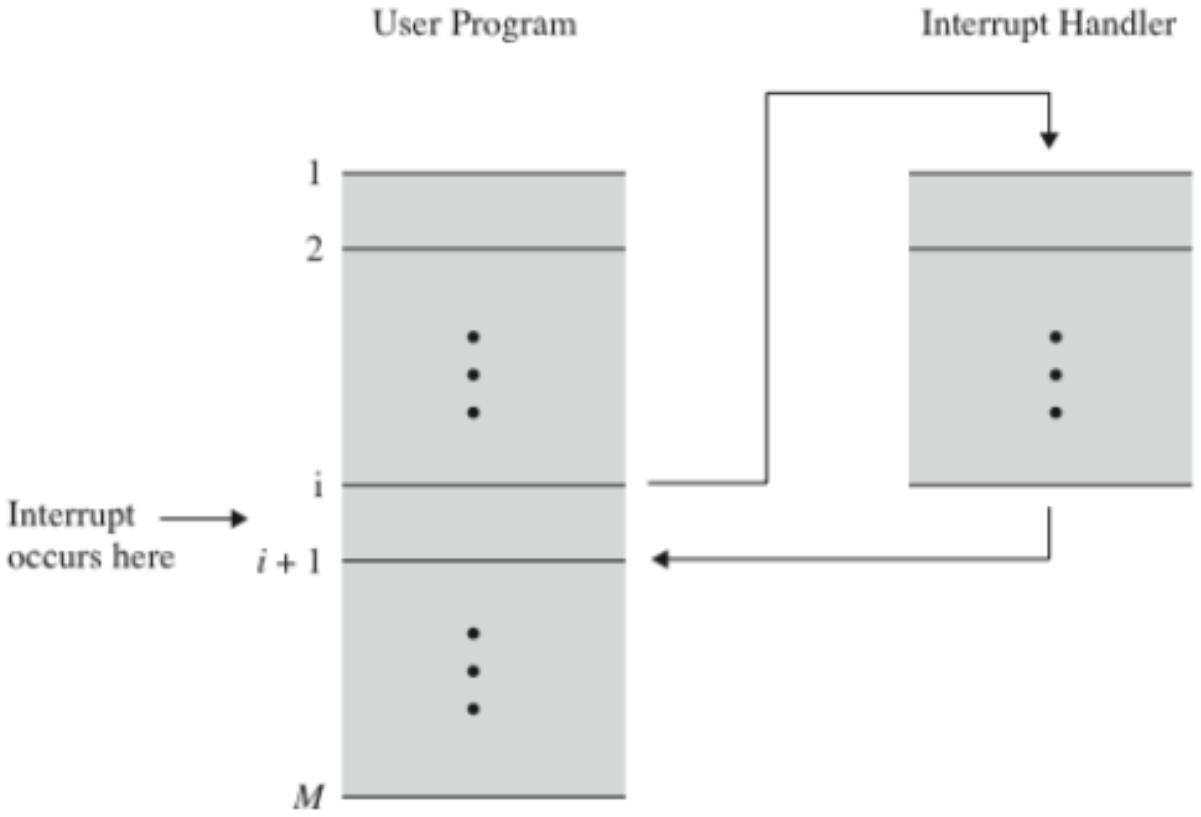




Rotina tratamento interrupção

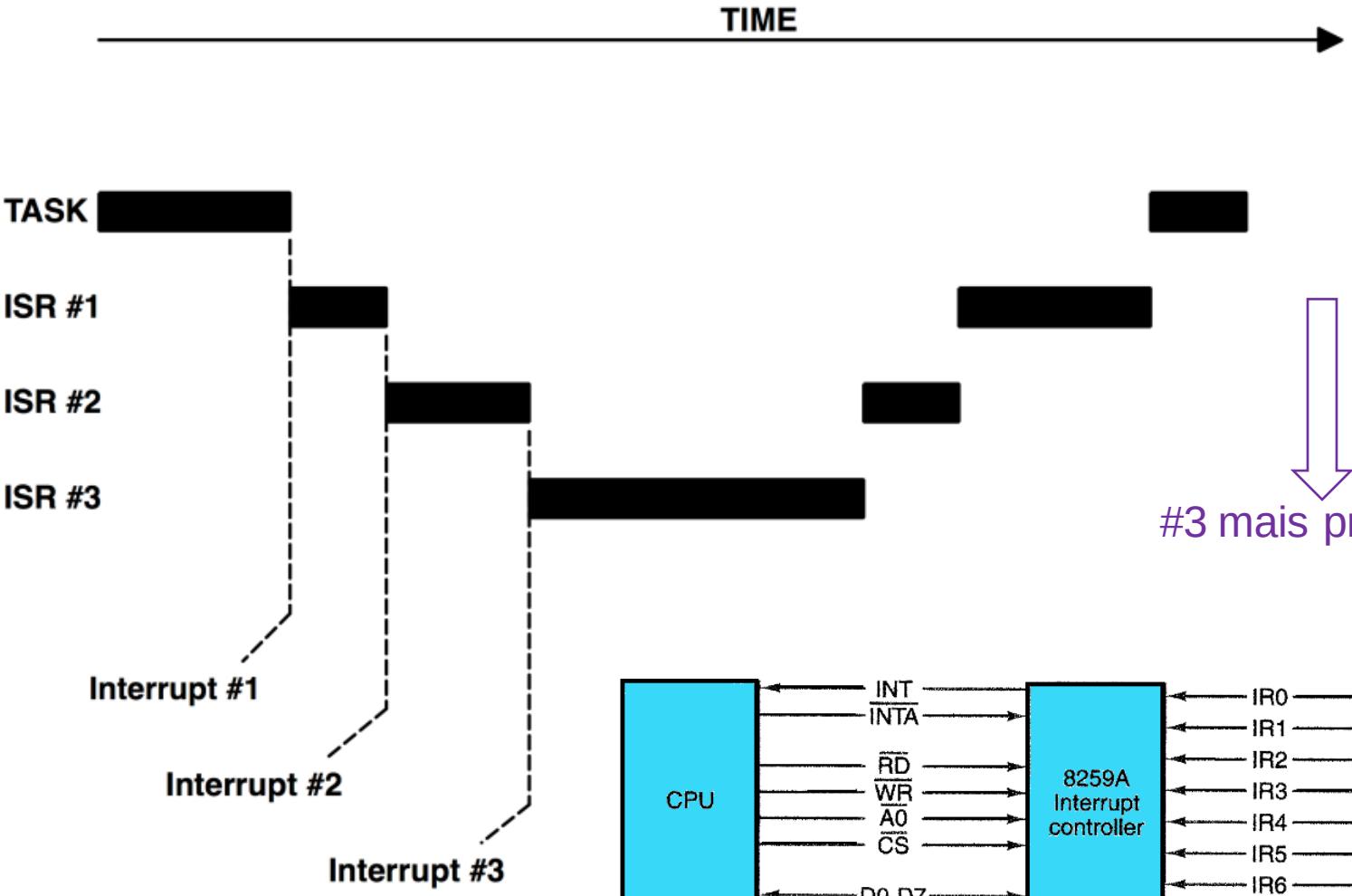
Fontes de interrupção:

- **Hardware**
- **Processador**
- **Software**

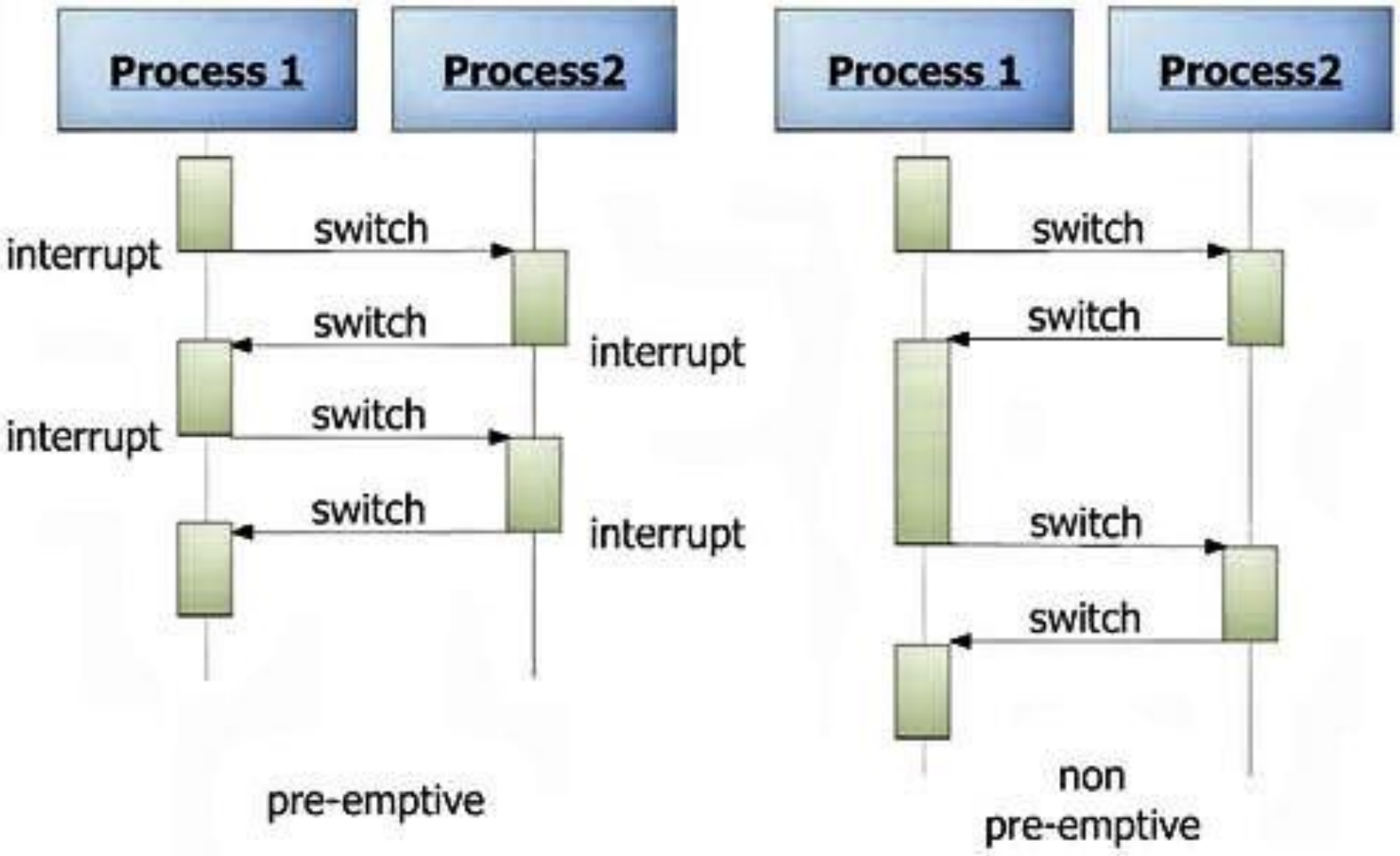


- **salva contexto**
- **TRATA INTERRUPÇÃO**
- **restaura contexto**
- **retorna**

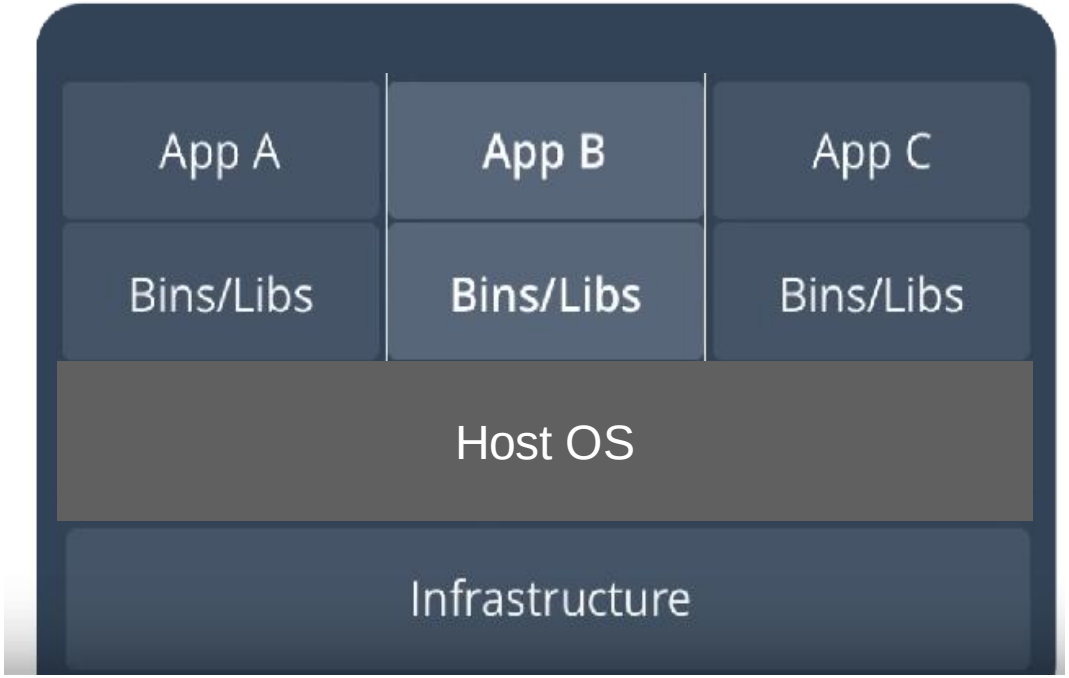
Interrupção



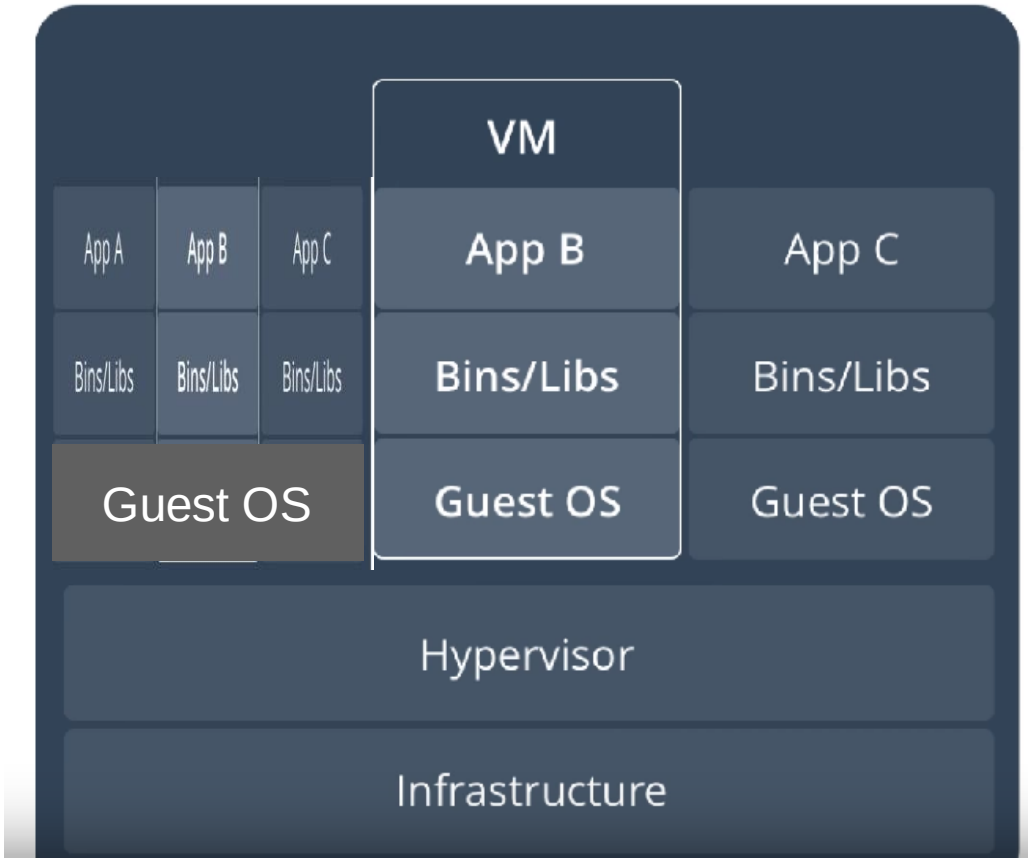
Multiprocessamento



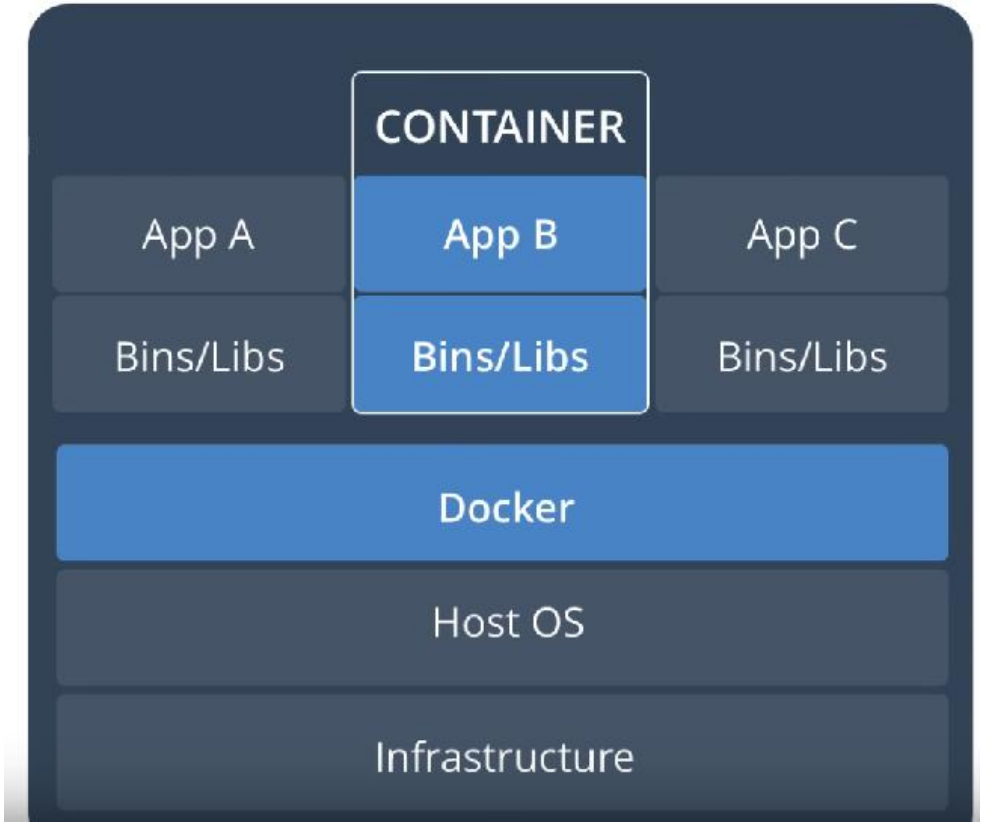
Multiprocessamento



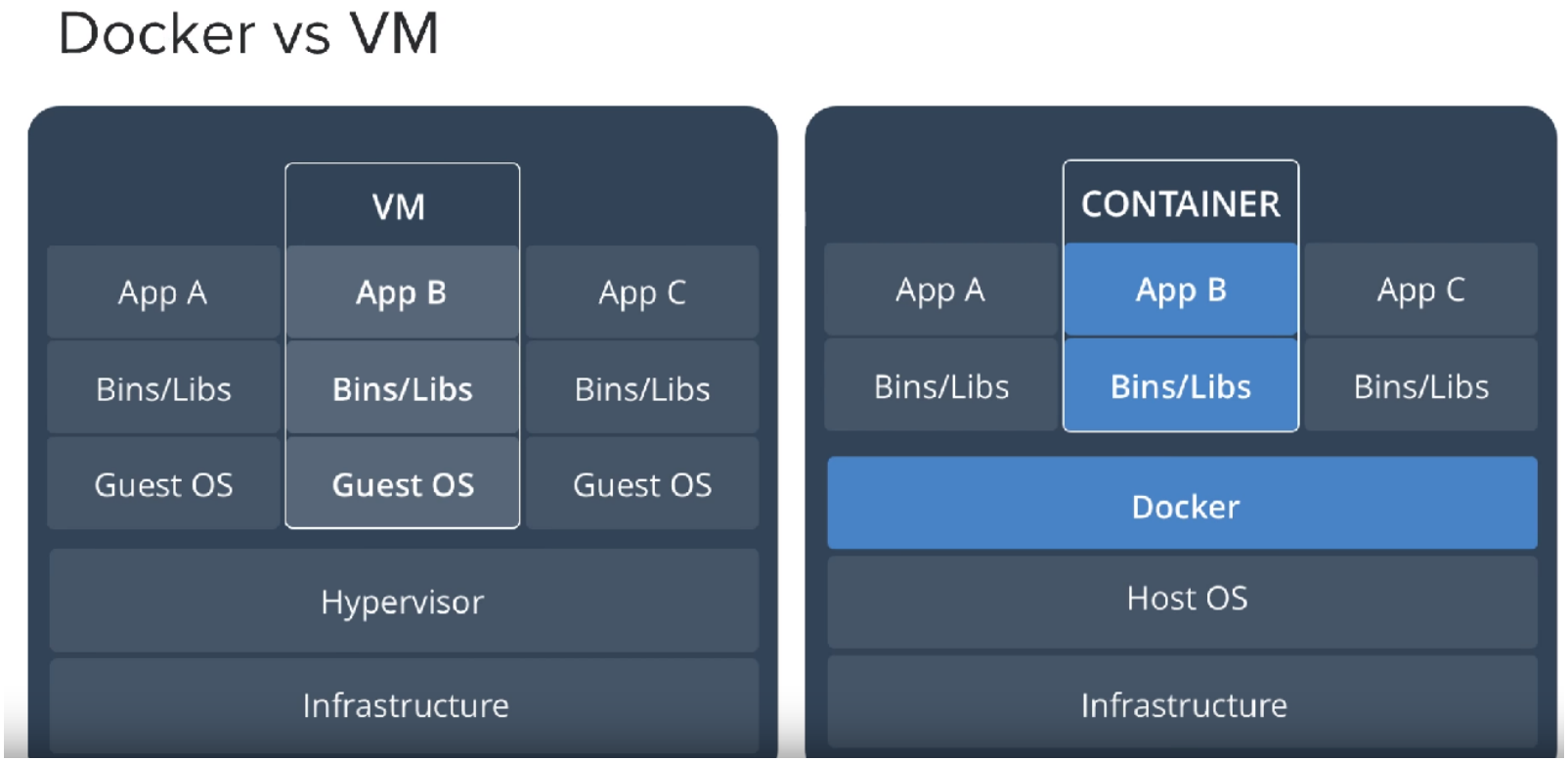
Virtualização



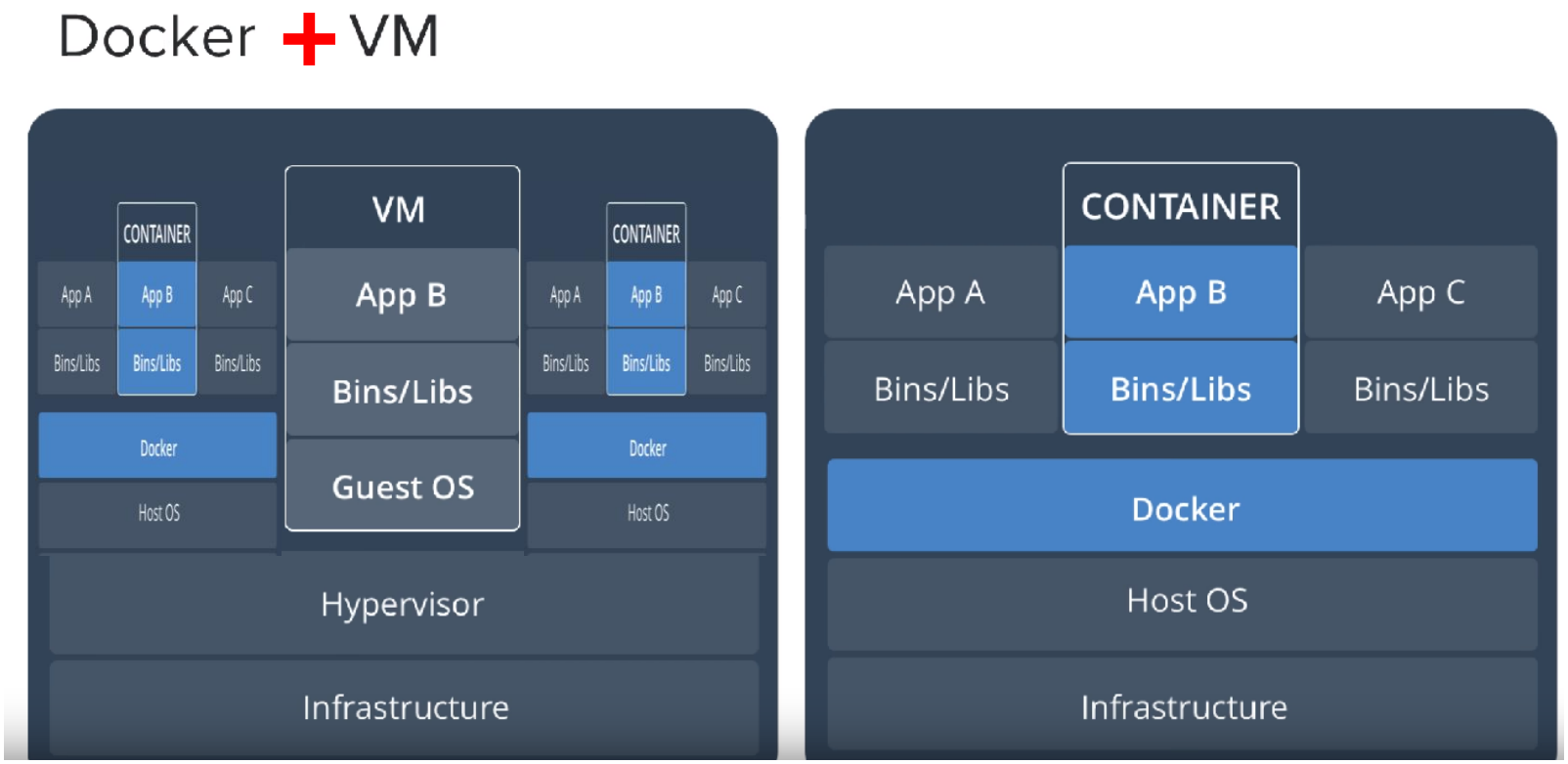
Containerização



Container x VM



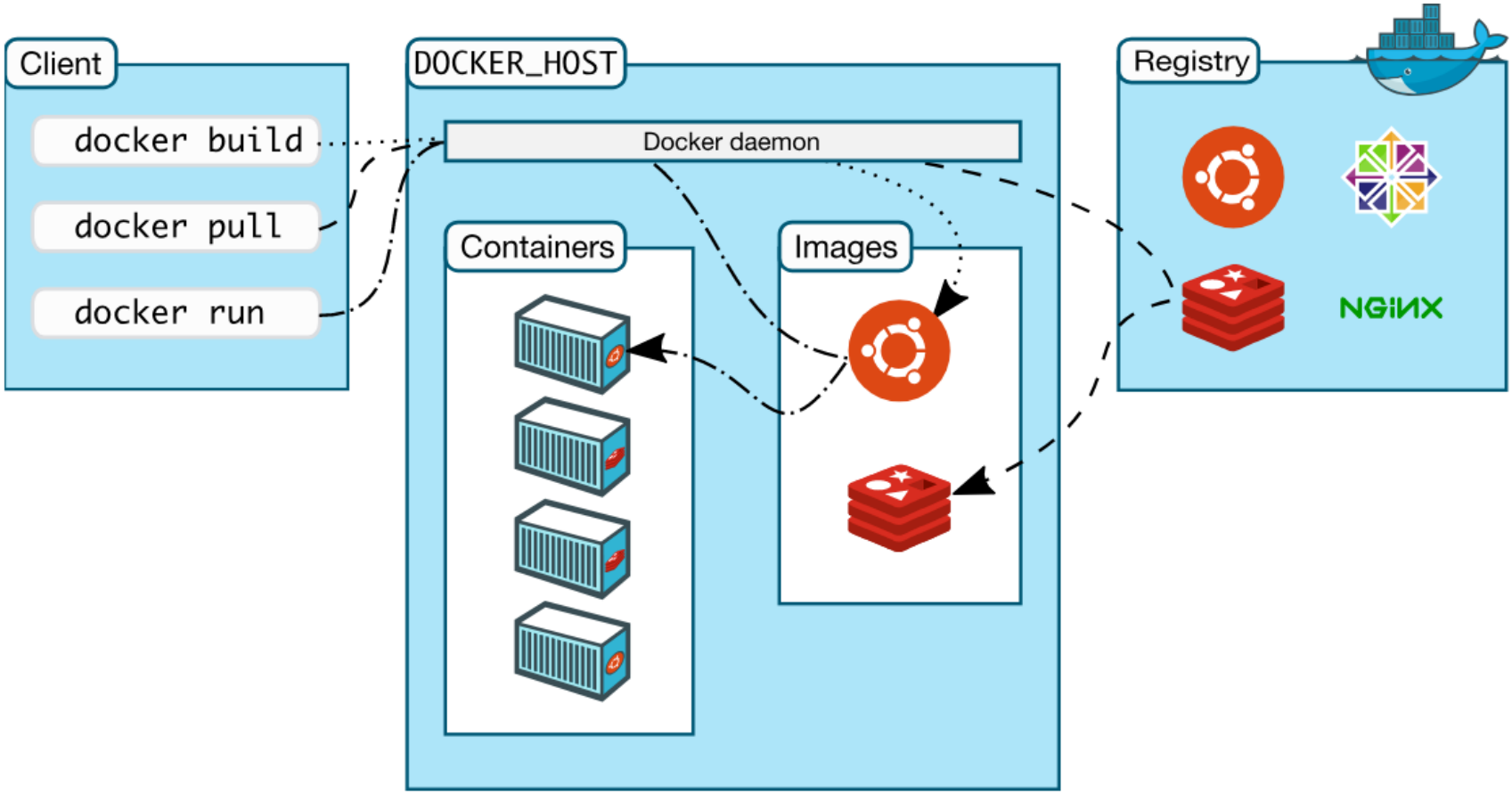
Containers + VMs



Docker

- Plataforma para desenvolvedores e sysadmins
- Desenvolvimento, deploy e execução de aplicações
- Utiliza containers Linux para o deploy de aplicações
- Flexibilidade: qualquer aplicação pode ser containerizada
- Leve: deploy de atualizações e upgrades *on-the-fly*
- Portabilidade: build local, deploy to cloud, run anywhere
- Escalável: distribuição automática de réplicas de containers

Arquitetura Docker



Vantagens Docker

- Agiliza o ciclo de vida do desenvolvimento
- Ambiente padrão utilizando containers
- Desenvolvedores escrevem código localmente e compartilham
- Transferência de aplicações para ambiente de testes
- Re-deploy de upgrades e atualizações para ambiente de testes
- Ambiente de produção utilizando mesmas imagens
- Compatibilidade com ambientes diversos misturados
  - Laptop do desenvolvedor
  - Máquinas físicas e virtuais em datacenters
  - Provedores da nuvem
- Alternativa competitiva para potencializar as máquinas virtuais
- Eficiência em pequenos e médios deployments
- Ambientes Linux, Windows e MacOS
- Plataformas VMWare, Amazon AWS, Microsoft Azure

Dockerfile

- Define o que será incluído no container
- Documento contendo comandos para montar a imagem
- Docker monta imagens automaticamente a partir do Dockerfile

Exemplos de comandos típicos:

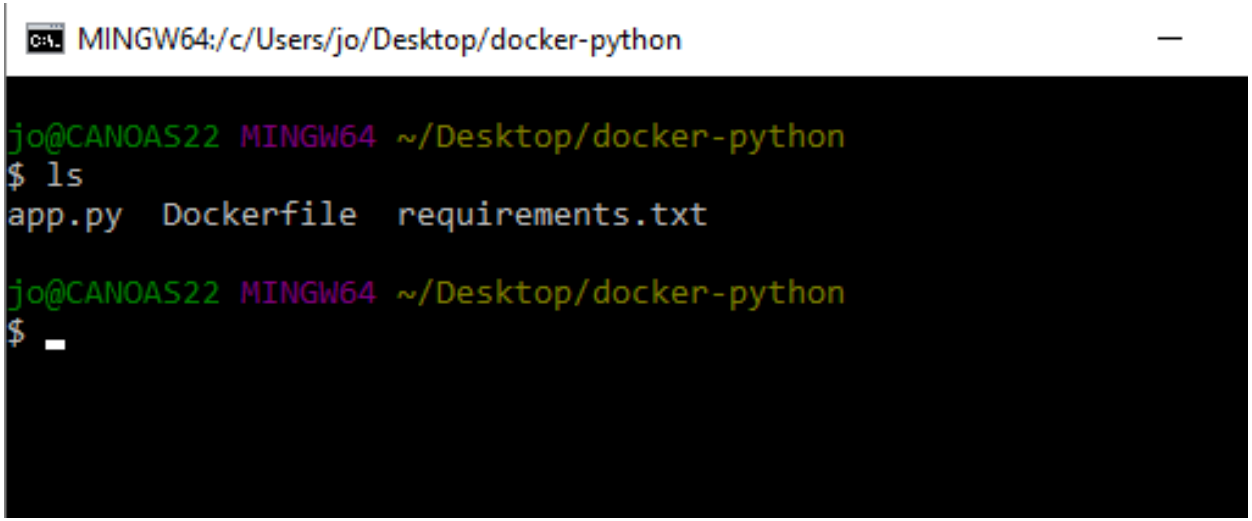
- docker info
- docker build .
- docker run -it -p 80:80 nginx

- docker push usuario/imagem:latest
- docker pull usuario/imagem:latest
- docker run usuario/imagem:latest

Dockerfile

Hello World com Python:

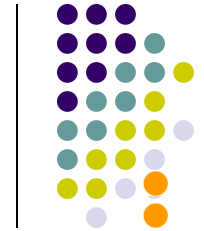
- docker build -t bamplifier/docker-python-test .
- docker run -p 4000:80 bamplifier/docker-python-test
- docker push bamplifier/docker-python-test
- docker pull bamplifier/docker-python-test



Dockerfile

```
jo@CANOAS22 MINGW64 ~/Desktop/docker-python
$ cat dockerfile
# Use an official Python runtime as a parent image
FROM python:2.7-slim

# Set the working directory to /app
WORKDIR /app

# Copy the current directory contents into the container at /app
ADD . /app

# Install any needed packages specified in requirements.txt
RUN pip install --trusted-host pypi.python.org -r requirements.txt

# Make port 80 available to the world outside this container
EXPOSE 80

# Define environment variable
ENV NAME World

# Run app.py when the container launches
CMD ["python", "app.py"]
jo@CANOAS22 MINGW64 ~/Desktop/docker-python
$
```

App.py



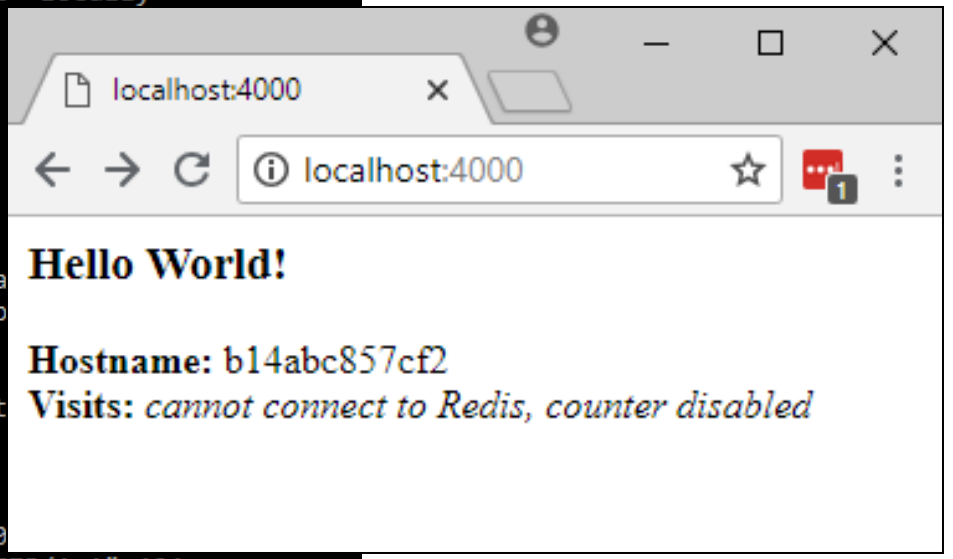
```
$ cat app.py
from flask import Flask
from redis import Redis, RedisError
import os
import socket

# Connect to Redis
redis = Redis(host="redis", db=0, socket_connect_timeout=2, socket_timeout=2)

app = Flask(__name__)

@app.route("/")
def hello():
    try:
        visits = redis.incr("counter")
    except RedisError:
        visits = "<i>cannot connect to Redis, counter disabled</i>"

    html = "<h3>Hello {name}!</h3>" \
           "<b>Hostname:</b> {hostname}<br/>" \
           "<b>Visits:</b> {visits}"
    return html.format(name=os.getenv("NAME", "world"), hostname=socket.gethostname(), visits=visits)

if __name__ == "__main__":
    app.run(host='0.0.0.0', port=80)

jo@CANOAS22 MINGW64 ~/Desktop/docker-python
$
```

Demo Build

```
$ docker build .
Sending build context to Docker daemon   5.12kB
Step 1/7 : FROM python:2.7-slim
2.7-slim: Pulling from library/python
683abbb4ea60: Already exists
8af590abc616: Already exists
f6cf6c5b7946: Already exists
e61a0272532e: Already exists
Digest: sha256:8ccd3a1e1836e2d1d1abda0c7f56b726fe70e2f4148190ce38456021c5ffc744
Status: Downloaded newer image for python:2.7-slim
 ---> 02ca219cf841
Step 2/7 : WORKDIR /app
Removing intermediate container 1b7090cd5e6e
 ---> d7d5a1318761
Step 3/7 : ADD . /app
 ---> e7a0d7e210ad
Step 4/7 : RUN pip install --trusted-host pypi.python.org -r requirements.txt
 ---> Running in 8690b6d6a8f8
Collecting Flask (from -r requirements.txt (line 1))
  Downloading https://files.pythonhosted.org/packages/7f/e7/08578774ed4536d3242b14dacb4696386634607af824ea997202cd0edb4b/Flask-1.0.2-py2.py3-none-any.whl (91kB)
Collecting Redis (from -r requirements.txt (line 2))
  Downloading https://files.pythonhosted.org/packages/3b/f6/7a76333cf0b9251ecf49efff635015171843d9b977e4ffcf59f9c4428052/redis-2.10.6-py2.py3-none-any.whl (64kB)
Collecting itsdangerous>=0.24 (from Flask->-r requirements.txt (line 1))
  Downloading https://files.pythonhosted.org/packages/dc/b4/a60bcdba945c00f6d608d8975131ab3f25b22f2bcfe1dab221165194b2d4/itsdangerous-0.24.tar.gz (46kB)
Collecting Jinja2>=2.10 (from Flask->-r requirements.txt (line 1))
  Downloading https://files.pythonhosted.org/packages/7f/ff/ae64bacdfc95f27a016a7bed8e8686763ba4d277a78ca76f32659220a731/Jinja2-2.10-py2.py3-none-any.whl (126kB)
Collecting Werkzeug>=0.14 (from Flask->-r requirements.txt (line 1))
  Downloading https://files.pythonhosted.org/packages/20/c4/12e3e56473e52375aa29c4764e70d1b8f3efa6682bef8d0aae04fe335243/Werkzeug-0.14.1-py2.py3-none-any.whl (322kB)
Collecting click>=5.1 (from Flask->-r requirements.txt (line 1))
  Downloading https://files.pythonhosted.org/packages/34/c1/8806f99713ddb993c5366c362b2f908f18269f8d792aff1abfd700775a77/click-6.7-py2.py3-none-any.whl (71kB)
Collecting MarkupSafe>=0.23 (from Jinja2>=2.10->Flask->-r requirements.txt (line 1))
  Downloading https://files.pythonhosted.org/packages/4d/de/32d741db316d8fdb7680822dd37001ef7a448255de9699ab4bfcbdf4172b/MarkupSafe-1.0.tar.gz
Building wheels for collected packages: itsdangerous, MarkupSafe
  Running setup.py bdist_wheel for itsdangerous: started
  Running setup.py bdist_wheel for itsdangerous: finished with status 'done'
  Stored in directory: /root/.cache/pip/wheels/2c/4a/61/5599631c1554768c6290b08c02c72d7317910374ca602ff1e5
  Running setup.py bdist_wheel for MarkupSafe: started
  Running setup.py bdist_wheel for MarkupSafe: finished with status 'done'
  Stored in directory: /root/.cache/pip/wheels/33/56/20/ebe49a5c612fffe1c5a632146b16596f9e64676768661e4e46
Successfully built itsdangerous MarkupSafe
Installing collected packages: itsdangerous, MarkupSafe, Jinja2, Werkzeug, click, Flask, Redis
Successfully installed Flask-1.0.2 Jinja2-2.10 MarkupSafe-1.0 Redis-2.10.6 Werkzeug-0.14.1 click-6.7 itsdangerous-0.24
Removing intermediate container 8690b6d6a8f8
 ---> ffed86045138
Step 5/7 : EXPOSE 80
 ---> Running in f9b1f54276d1
Removing intermediate container f9b1f54276d1
 ---> be10482adc5f
Step 6/7 : ENV NAME World
 ---> Running in e12809f3f0ee
Removing intermediate container e12809f3f0ee
 ---> e16a11f5b811
Step 7/7 : CMD ["python", "app.py"]
 ---> Running in 0ecf26397201
Removing intermediate container 0ecf26397201
 ---> 436b23ebf863
Successfully built 436b23ebf863
```

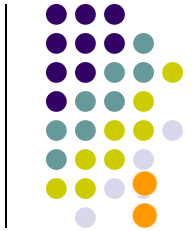
Running

```
$ docker run -p 4000:80 bamplifier/docker-python-test
Unable to find image 'bamplifier/docker-python-test:latest' locally
latest: Pulling from bamplifier/docker-python-test
683abbb4ea60: Already exists
8af590abc616: Already exists
f6cf6c5b7946: Already exists
e61a0272532e: Already exists
6134331c2d29: Already exists
b5569e5b6380: Already exists
7dcaf1b1b3b2: Already exists
Digest: sha256:5fc2627e0d94acb7f2e9af72e8f51822946e5c6deca
Status: Downloaded newer image for bamplifier/docker-pytho
 * Serving Flask app "app" (lazy loading)
 * Environment: production
   WARNING: Do not use the development server in a product
   Use a production WSGI server instead.
 * Debug mode: off
 * Running on http://0.0.0.0:80/ (Press CTRL+C to quit)
172.17.0.1 - - [11/Jul/2018 14:52:05] "GET / HTTP/1.1" 200
172.17.0.1 - - [11/Jul/2018 14:52:06] "GET /favicon.ico HTTP/1.1" 404 -
172.17.0.1 - - [11/Jul/2018 14:54:00] "GET / HTTP/1.1" 200 -
172.17.0.1 - - [11/Jul/2018 14:54:07] "GET / HTTP/1.1" 200 -
```



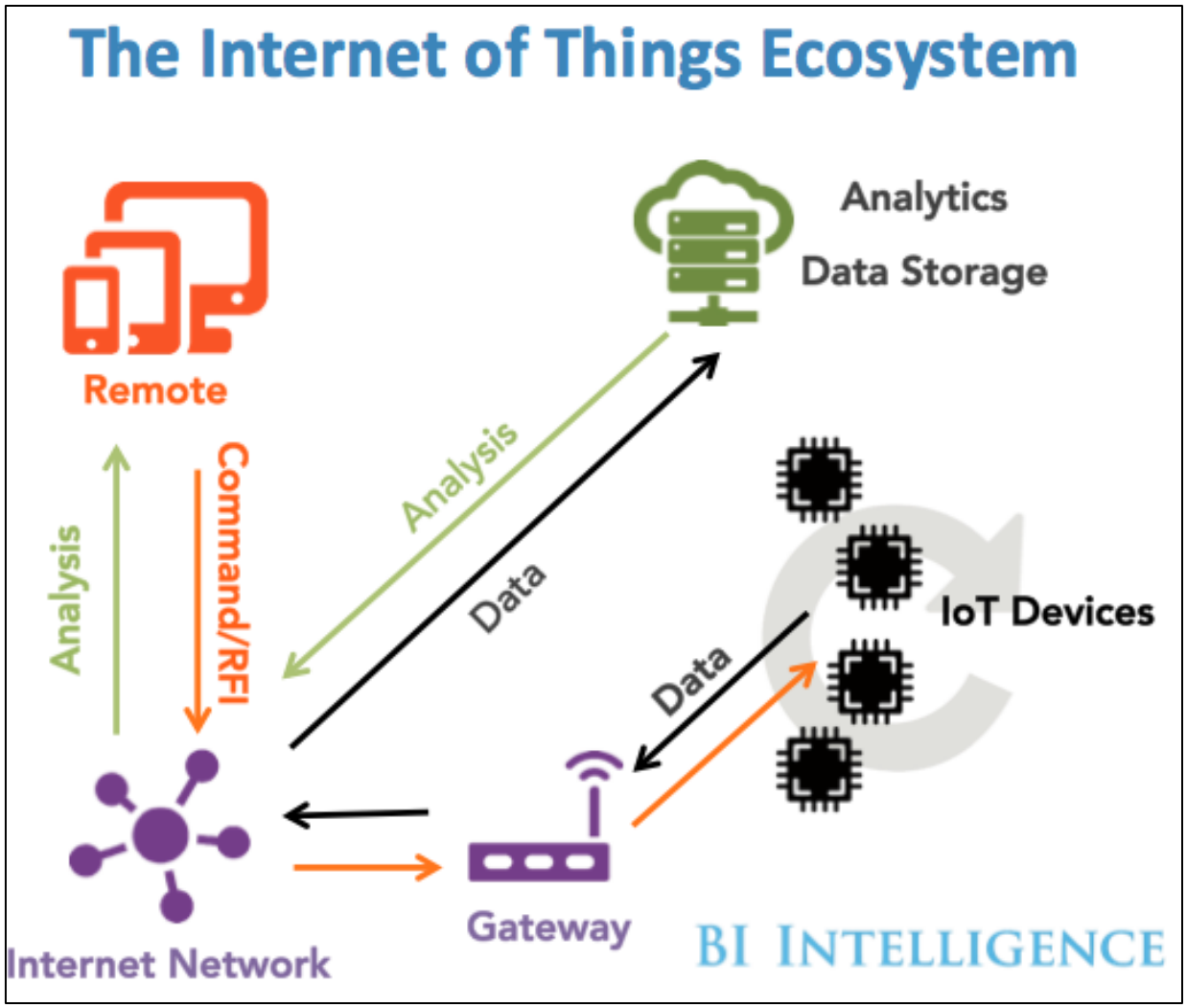

```
$ docker ps
CONTAINER ID        IMAGE                          COMMAND             CREATED             STATUS              PORTS
b14abc857cf2        bamplifier/docker-python-test  "python app.py"     38 minutes ago      Up 38 minutes       0.0.0.0:4000->80/tcp
```

Demo Docker-Python



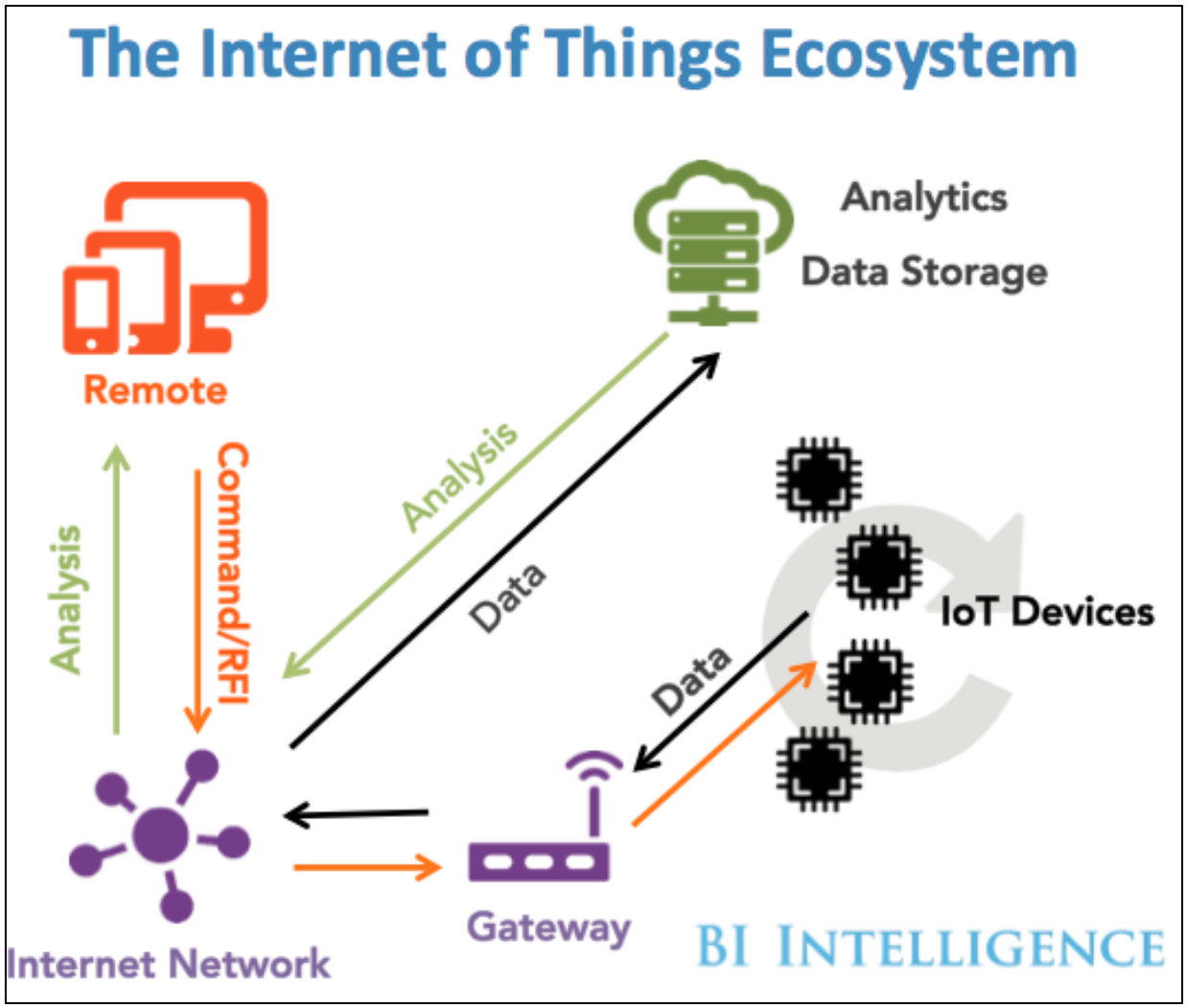
- Instalar Docker
- Demonstração

IoT: Internet of Things



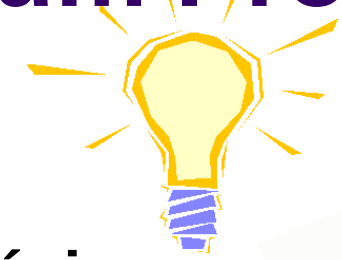
- Temos hoje **15 Bi** dispositivos ligados à Internet
- Em 5 anos, teremos dobrado para **30 Bi**
- Desses, **20 Bi** estarão ligados à iniciativas IoT

IoT: Internet of Things

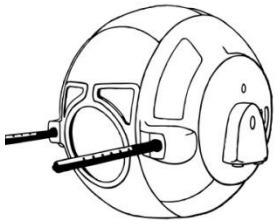


- Como minimizar **riscos** ao se **investir** em IoT?
- Como **acelerar** o **retorno** de projetos IoT?
- Como auxiliar na **decisão** de investidores e gerentes de IoT?

Fases de um Projeto IoT



- Boa idéia !
- Plano de Negócio
- Escolha do Time
- Escolha da Metodologia
- Prova de Conceito
  - IoT Starter
- Protótipo Piloto
- Produção Comercial



Prova de Conceito

- **Comprovado o potencial da iniciativa IoT;**
- **Já tendo um plano de negócio aceito por investidores;**
- **Escolhido um gerente executivo que lidera um time enxuto;**
- **Usando metodologia que potencializa o conhecimento intensivo;**
- **Planeja-se o início de um fluxo de trabalho contínuo e eficaz.**

Como iniciar já a construção de um protótipo?

Como provar se o conceito vale o investimento?

IoT Starter

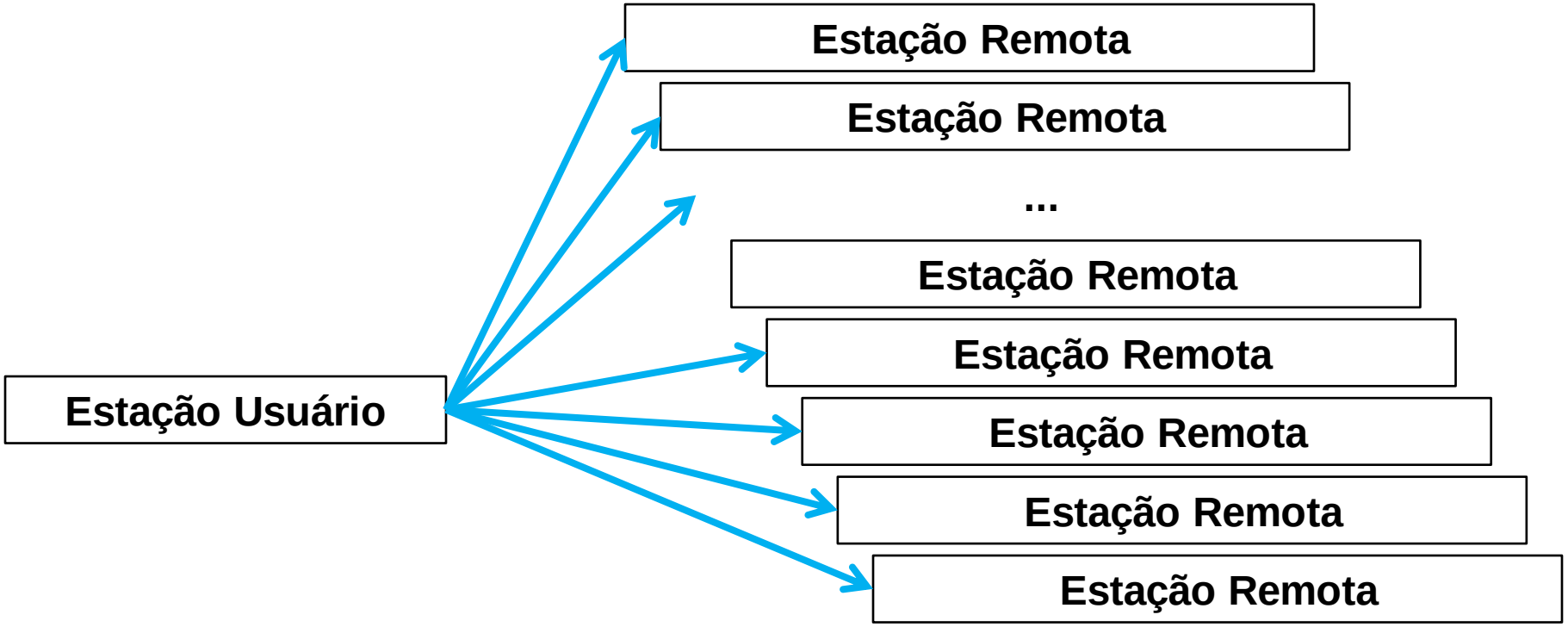
- Implantação do workflow da equipe
- Time de projeto e desenvolvimento entra em ação
- Agilização do processo de mudanças contínuas
- Montagem da infraestrutura de desenvolvimento inicial
- Escolha de frameworks e ferramentas desenvolvimento
- Sistema de desenvolvimento é interno ou externo?

Sistema de Desenvolvimento

- Compilador para linguagem de programação
- Utilitários para carga de código executável no produto
- Biblioteca de comunicação com os protocolos de rede
- Biblioteca de softwares utilitários do IoT Starter
- Bibliotecas customizadas para a iniciativa IoT
- Componentes de hardware para a prova de conceito
- Provedores de serviço na nuvem a considerar

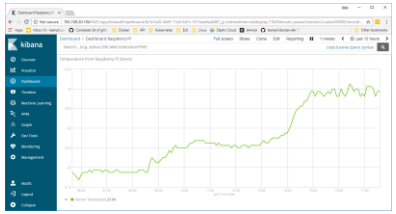
Projeto IoT: Estação do Clima

- Coleta de dados em tempo real por Estações Remotas
- Sensores de temperatura, pressão e umidade
- Painel do Clima na Estação do Usuário faz acompanhamento



Projeto IoT: Estação do Clima

Estação Usuário	Estação Remota	
x64-pc	arm-rpi	anavi-ir



KIBANA

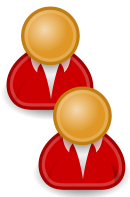
ELASTIC

LOGSTASH

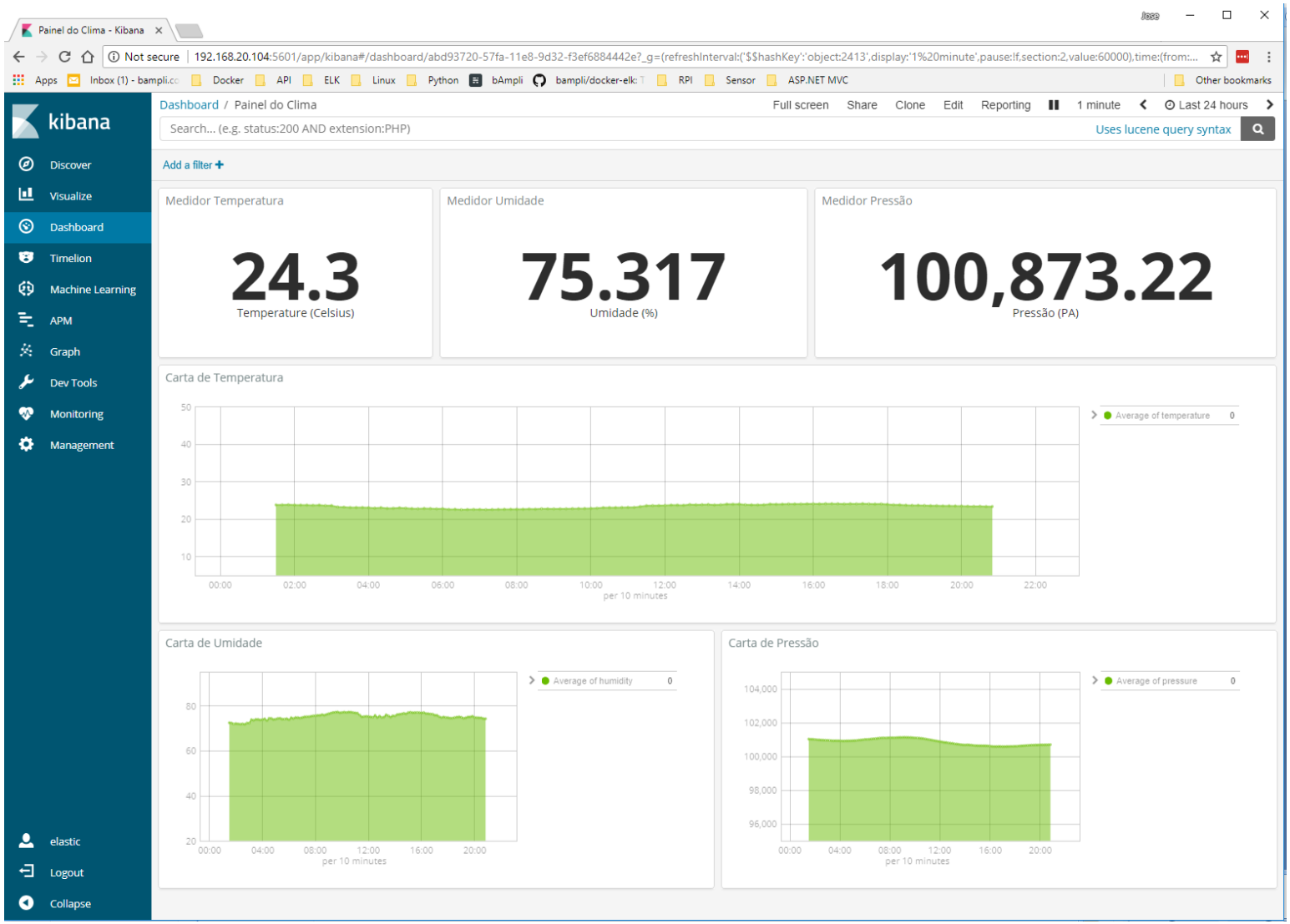
WEB SERVICE

SENSORES

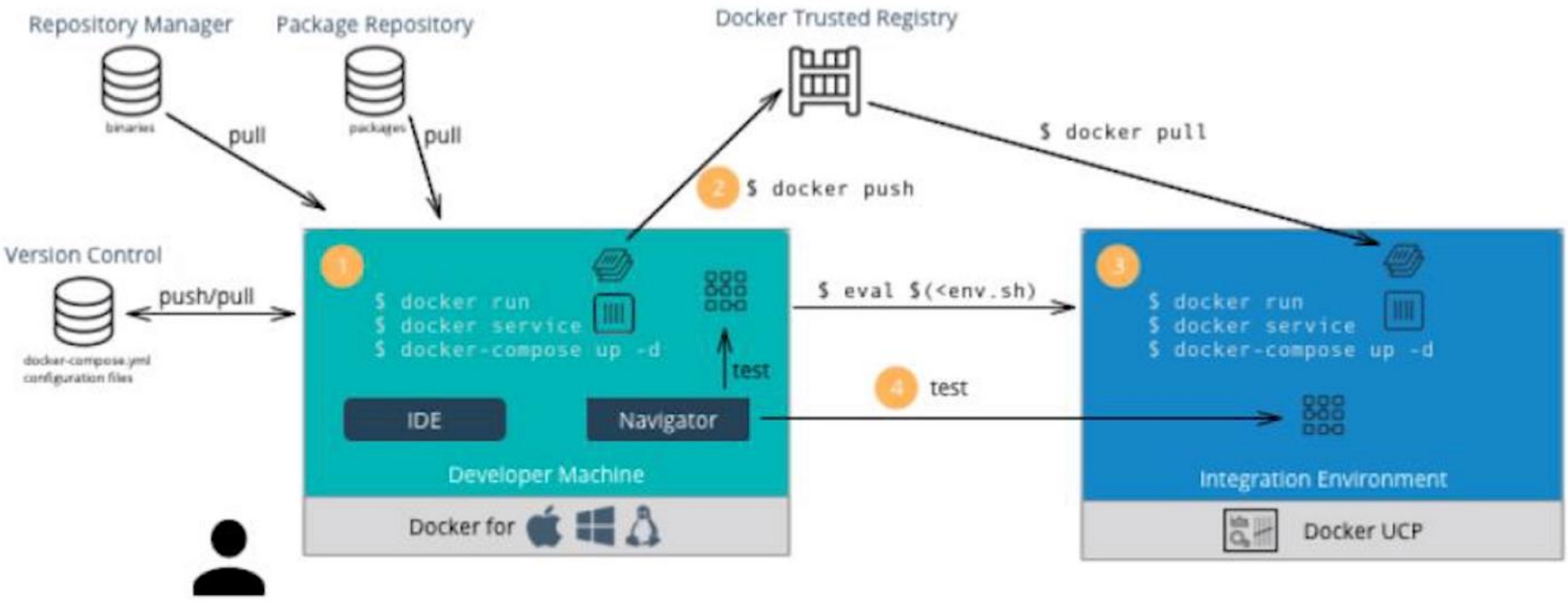
UI MVC



Painel do Clima



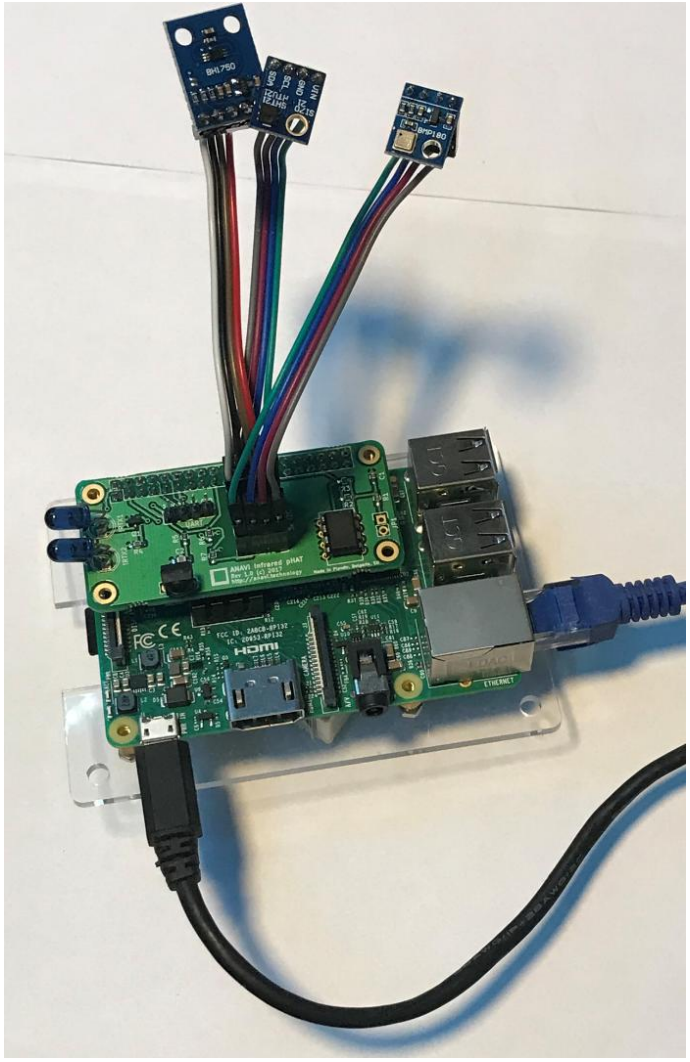
Workflow P&D Software



Estação Remota

- **Raspberry Pi 3 Model B**
  - CPU Quad Core 64-bit 1.2 GHz
  - 1 GB RAM
  - Micro SD 15 GB
  - Wireless Lan / Ethernet 100 Mbps
  - GPIO 40-pinos

- **ANAVI Infrared pHAT**
  - 2 x transmissores IR
  - Receptor IR photo sensor
  - Sensor pressão barométrica
  - Sensor temperatura e umidade
  - Sensor intensidade de luz



Estação Remota

A partir do IoT Starter Pi Thing:

- **API First Design**
- **SwaggerHub gera código de web service**
- **ASP.NET MVC gera código da interface usuário**
- **Visual Studio 2017 Community IDE integra projetos**
- **Build realizado em PC x64 veloz cria imagem Docker**
- **Push imagem para DockerHub registry**
- **Deploy na Raspberry Pi fazendo pull imagem**
- **Docker-Compose orquestra microservices & rede**

Estação Usuário

- **ELK Stack**
  - **Logstash rastreia informações**
  - **Elastic armazena informações**
  - **Kibana gera dashboard com gráficos**
- **Docker for Windows com CentOS Linux**
- **Orquestração Docker-Compose**