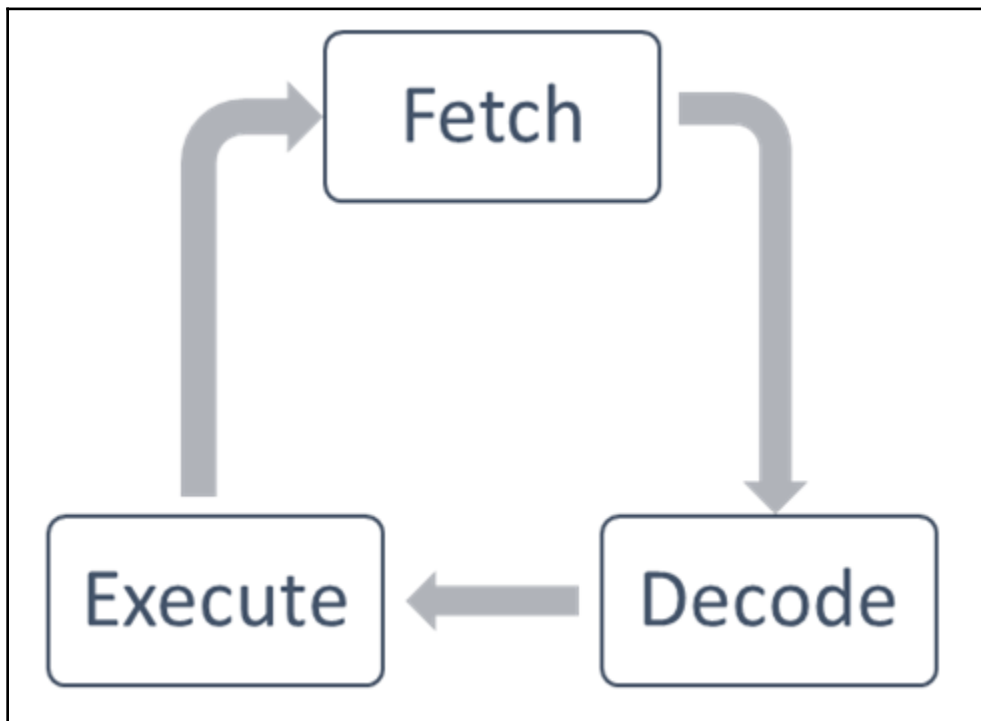
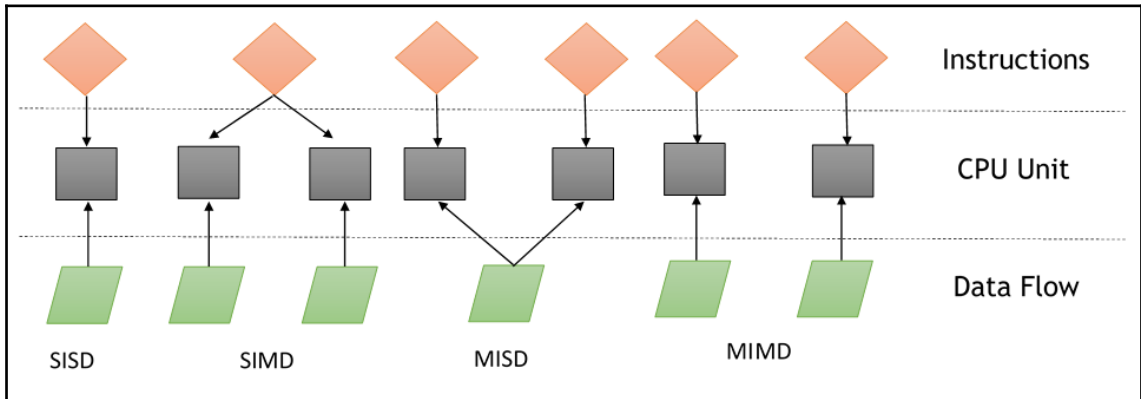
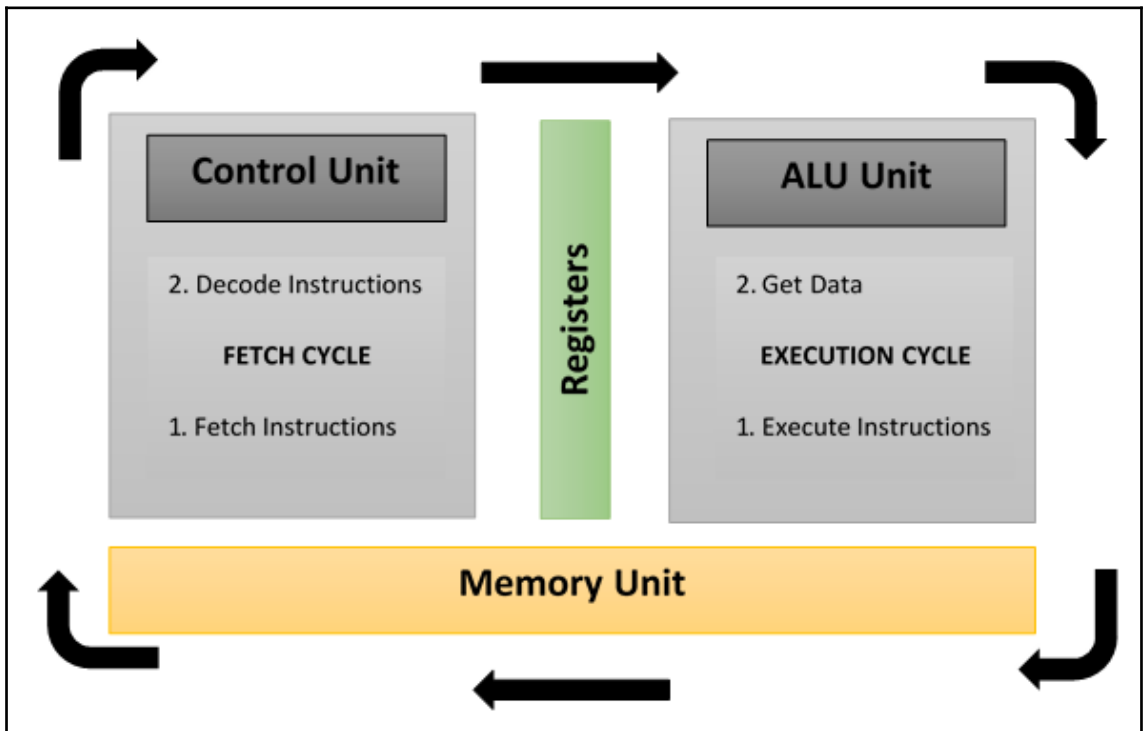
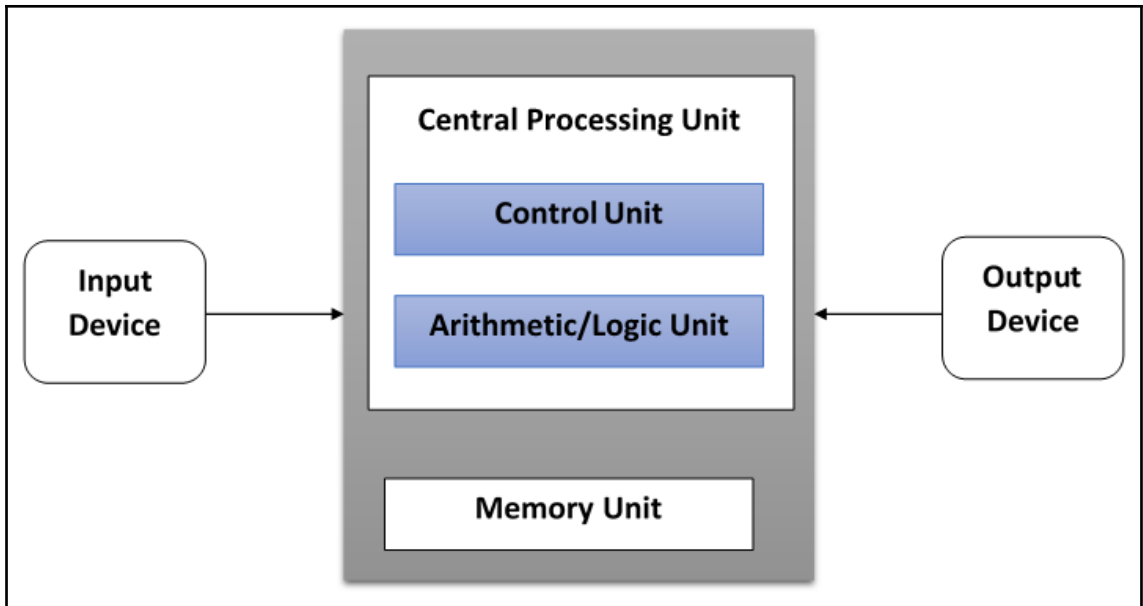
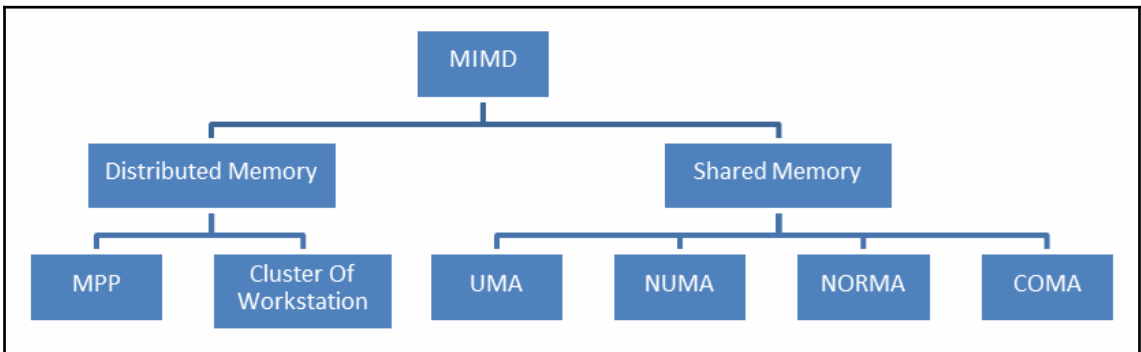
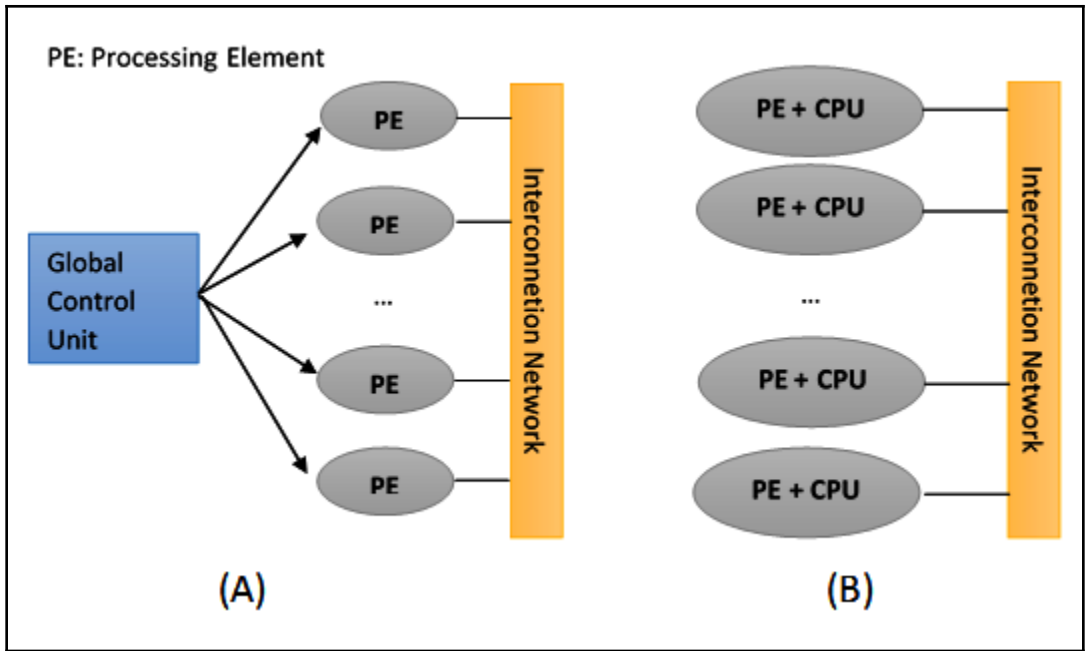
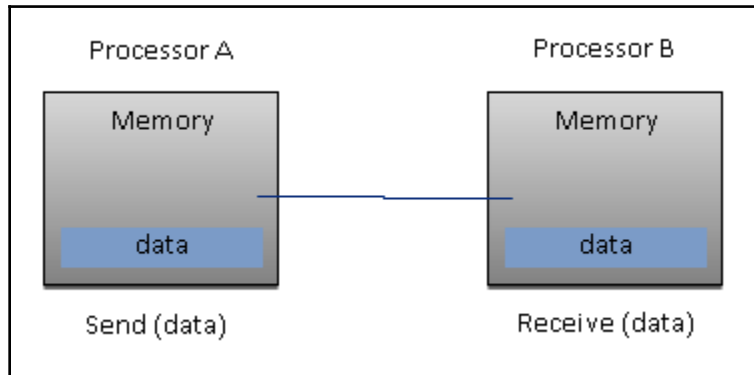
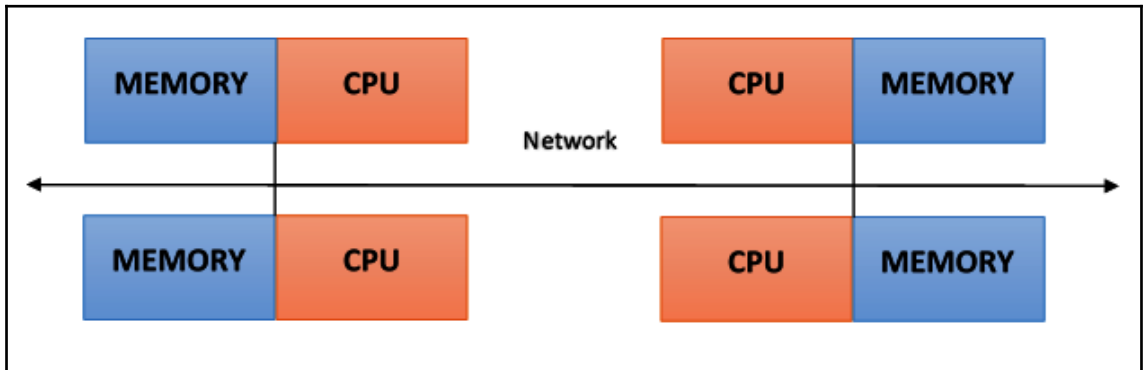
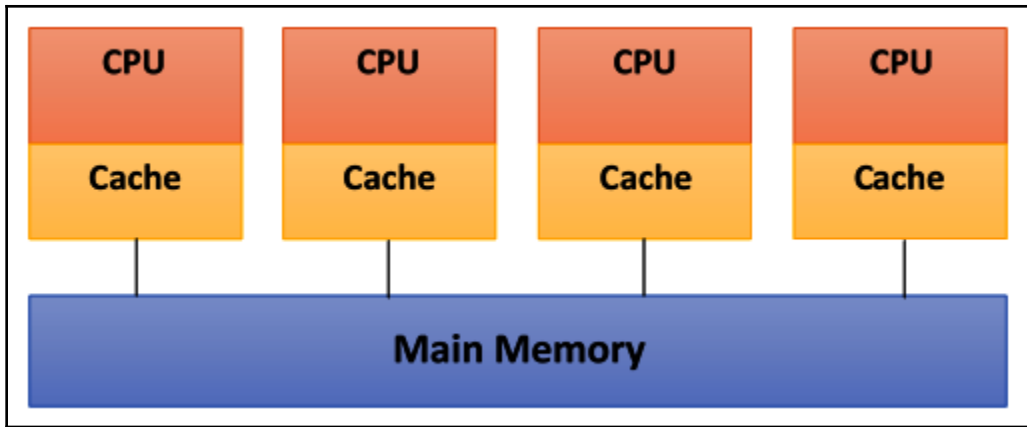


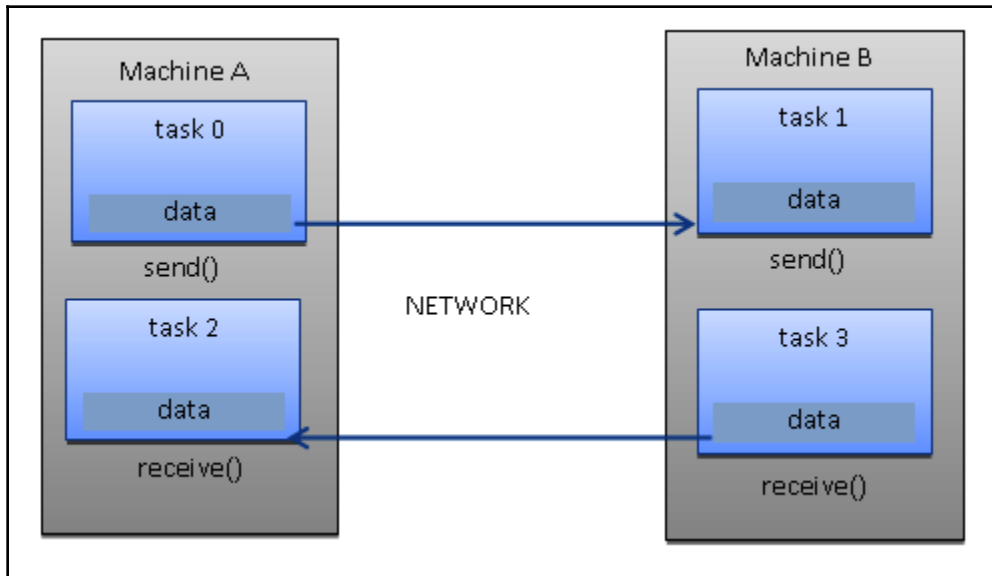
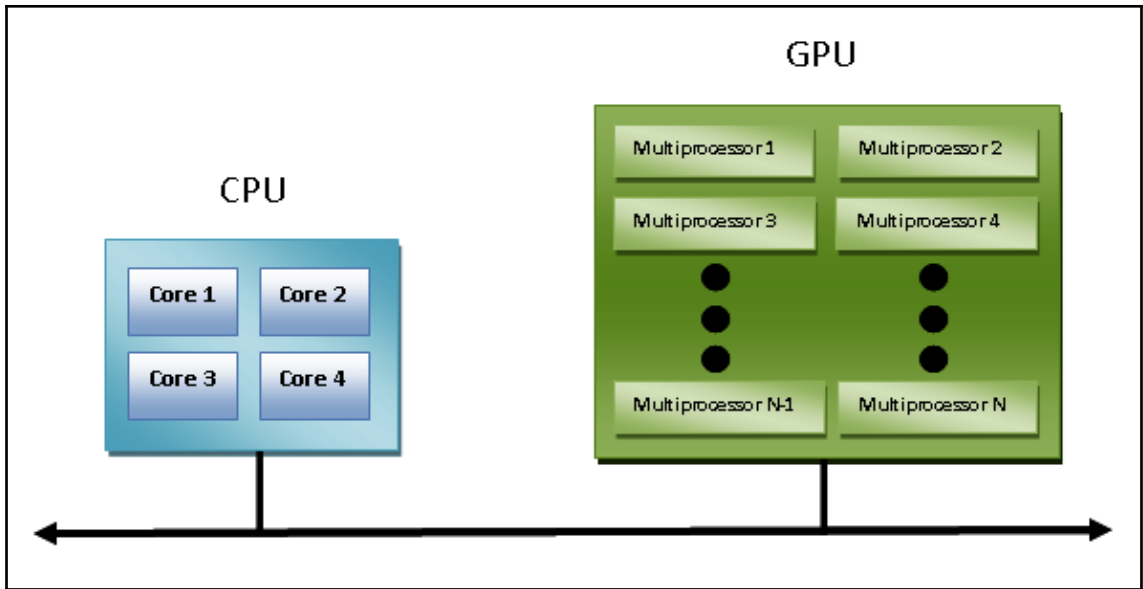
Chapter 1: Getting Started with Parallel Computing and Python

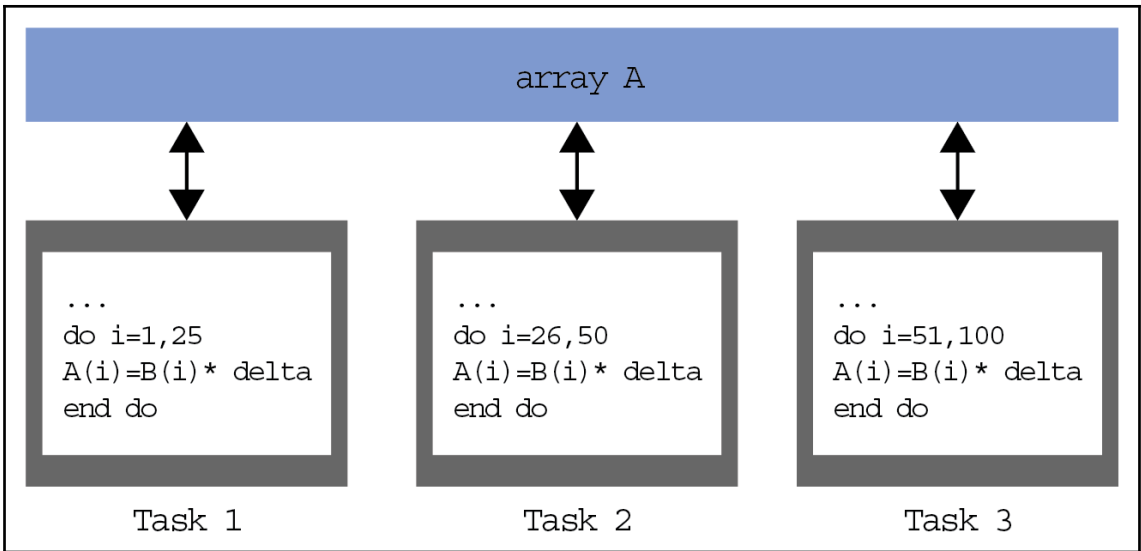




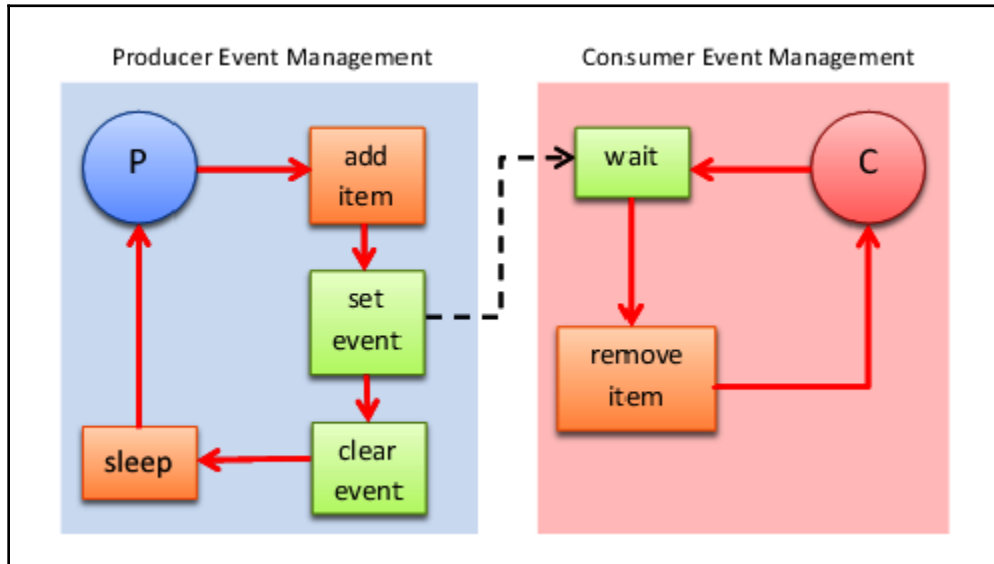
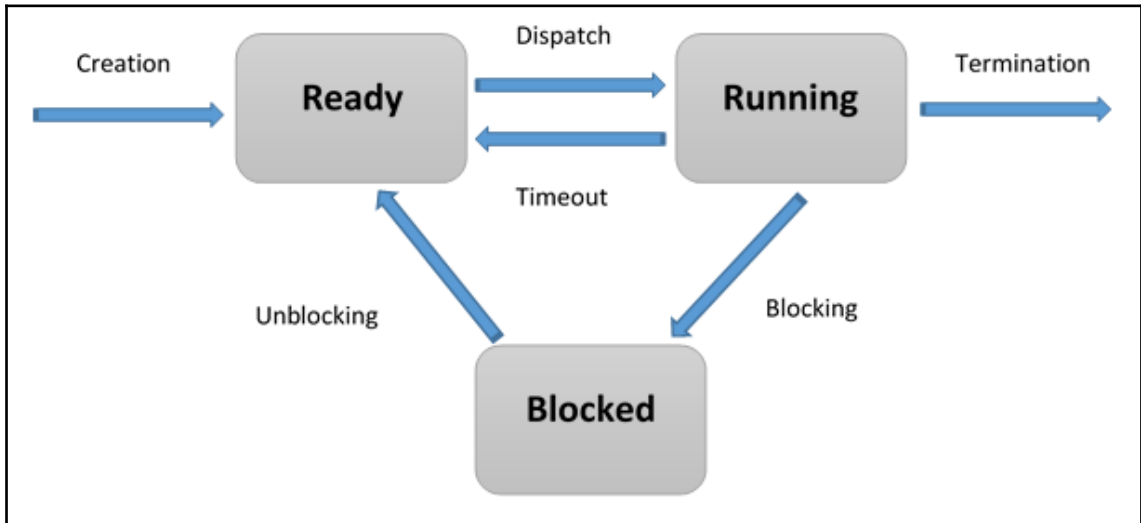


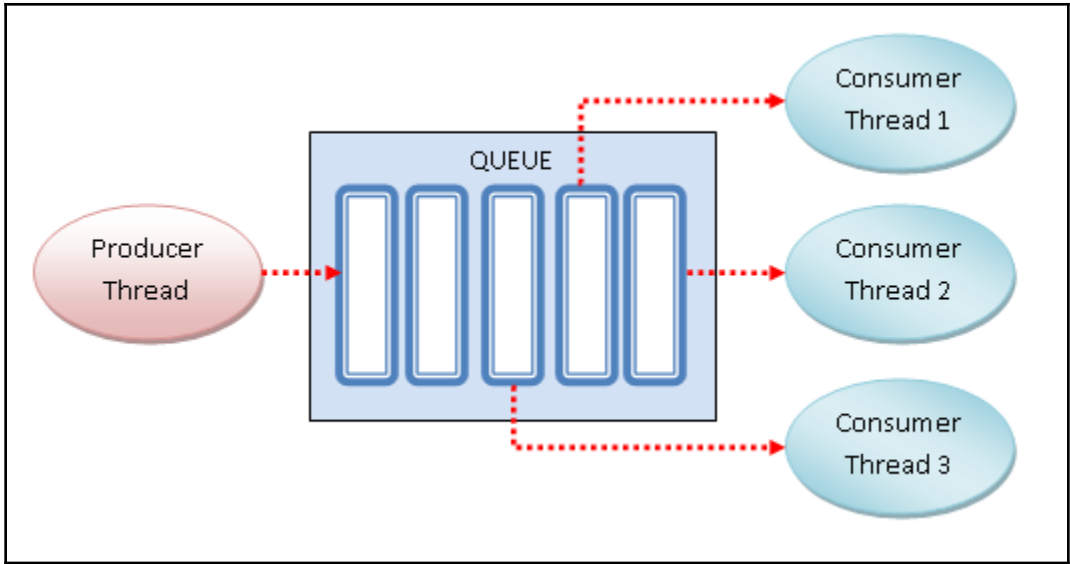




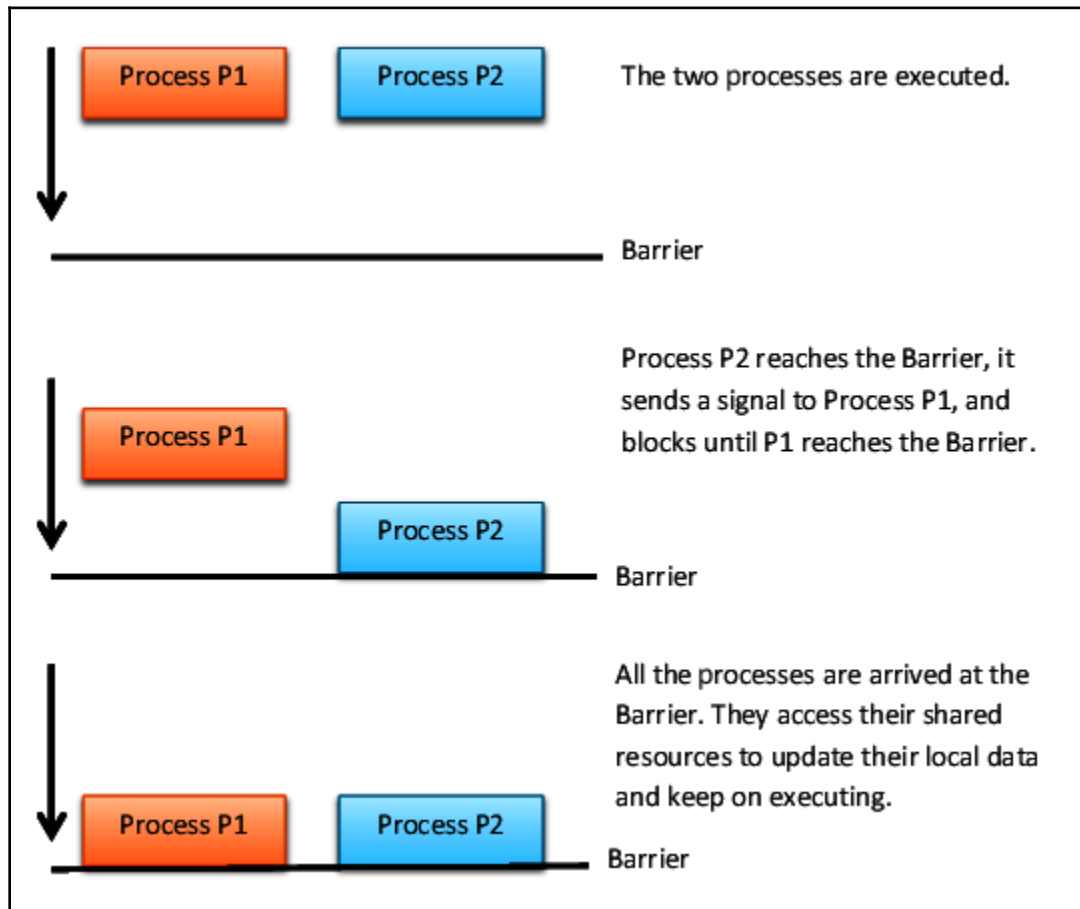


Chapter 2: Thread-Based Parallelism

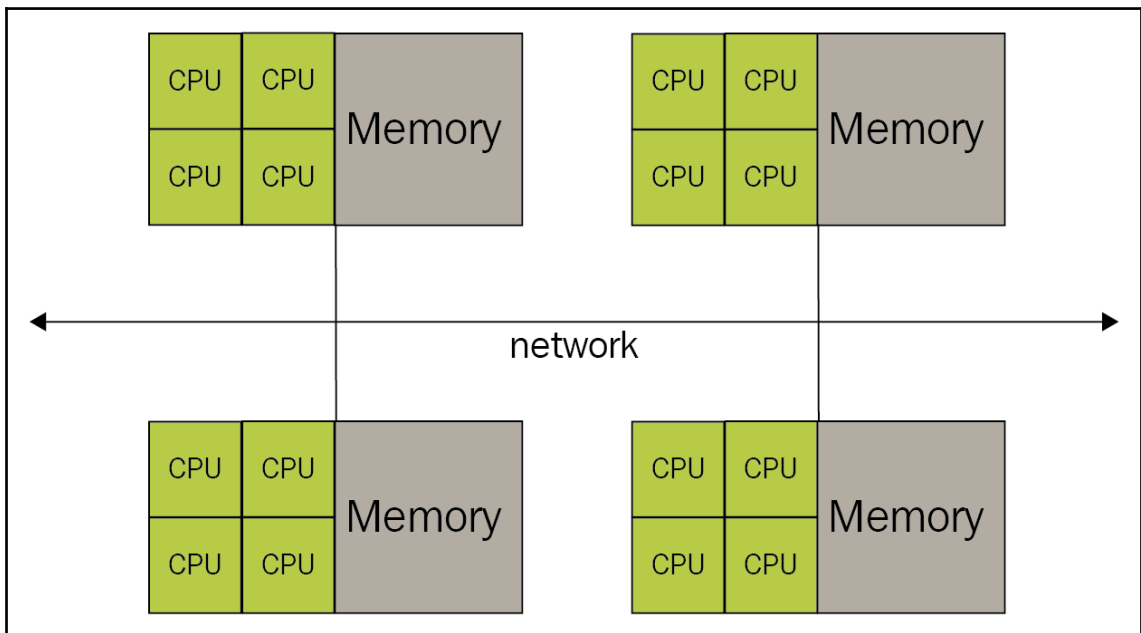
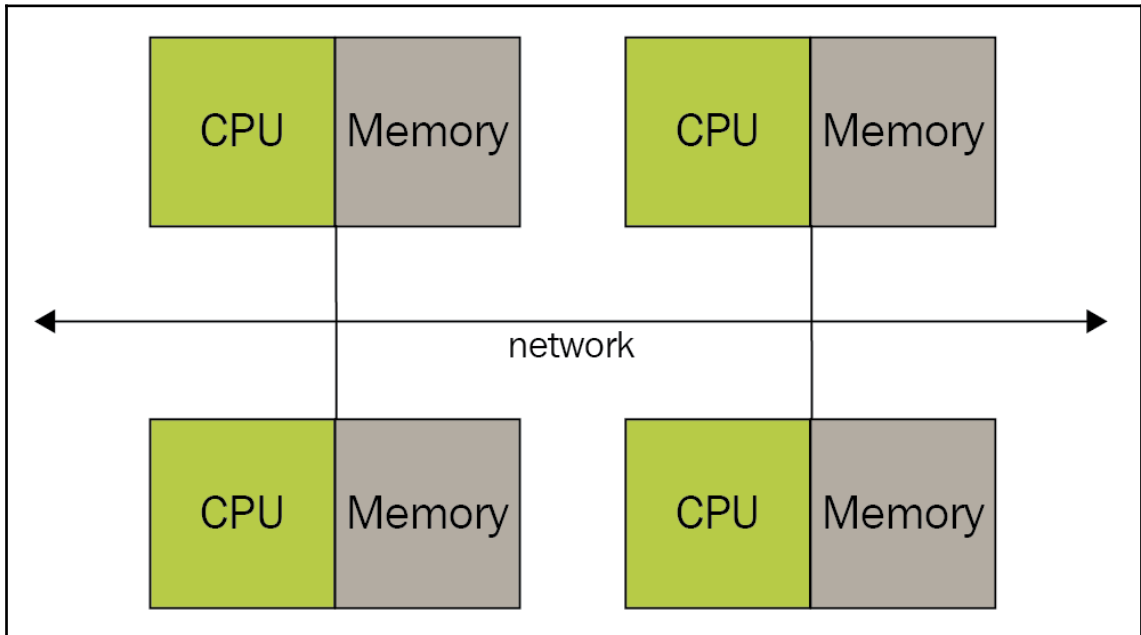


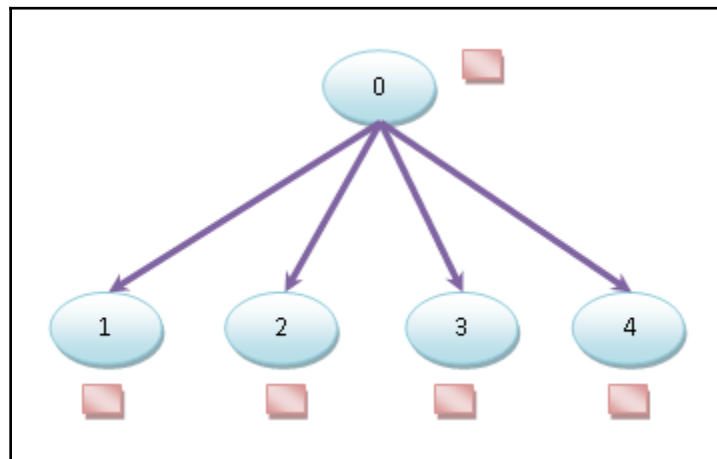
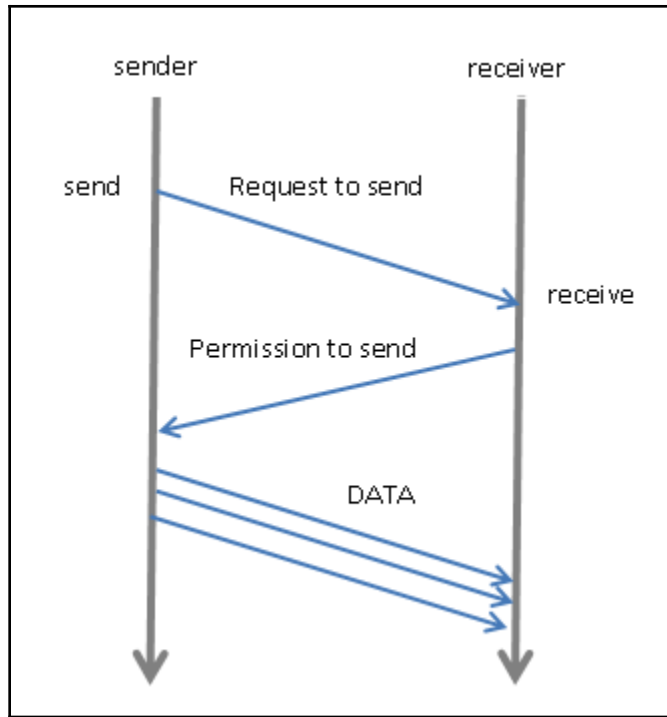


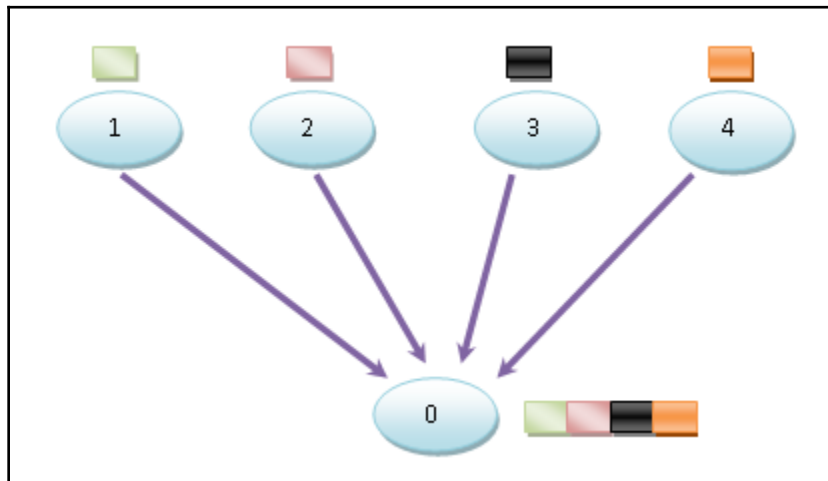
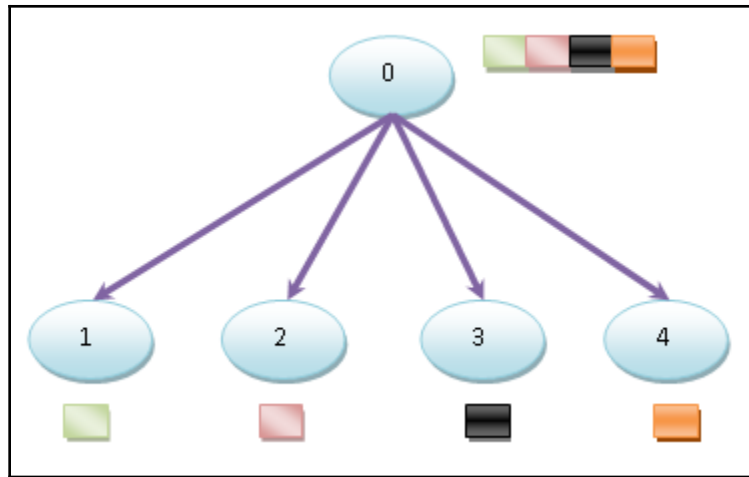
Chapter 3: Process-Based Parallelism



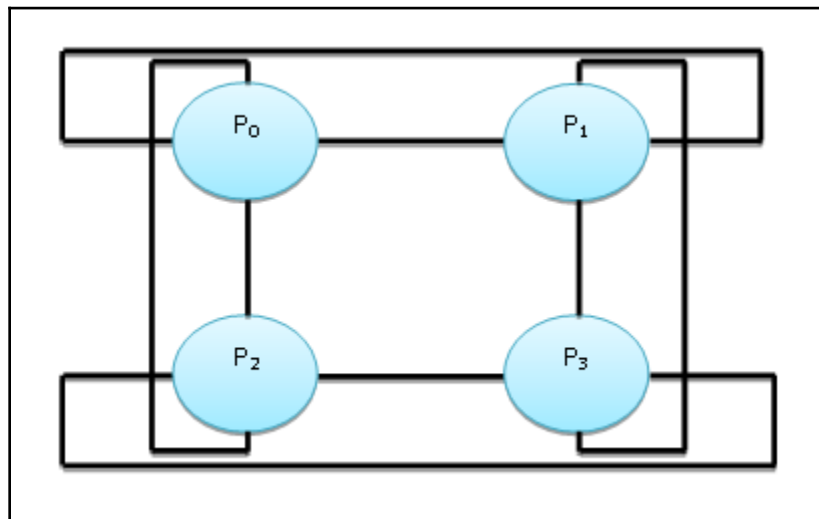
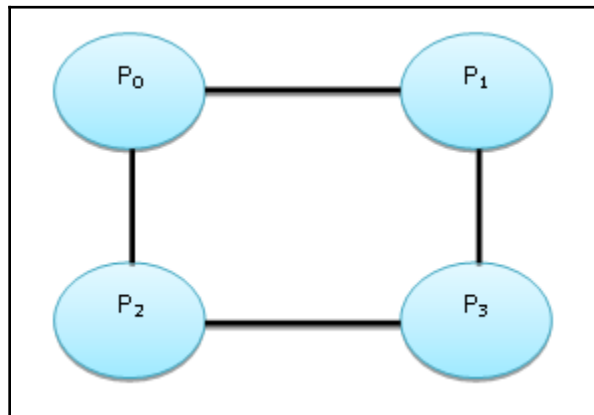
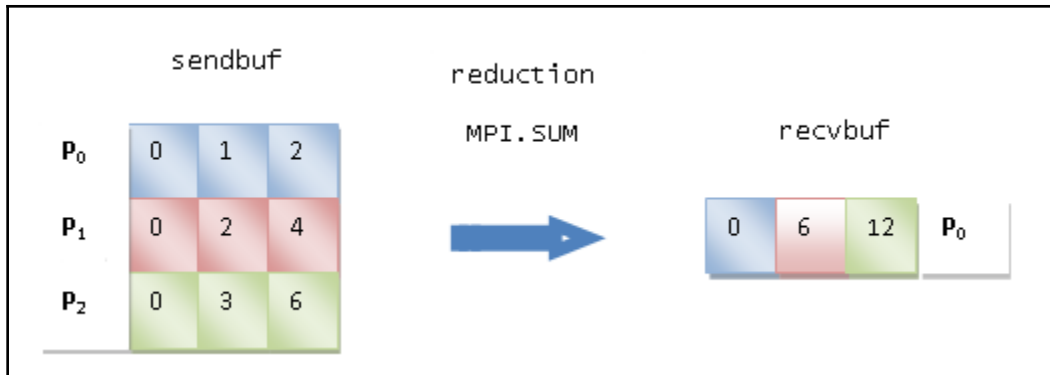
Chapter 4: Message Passing



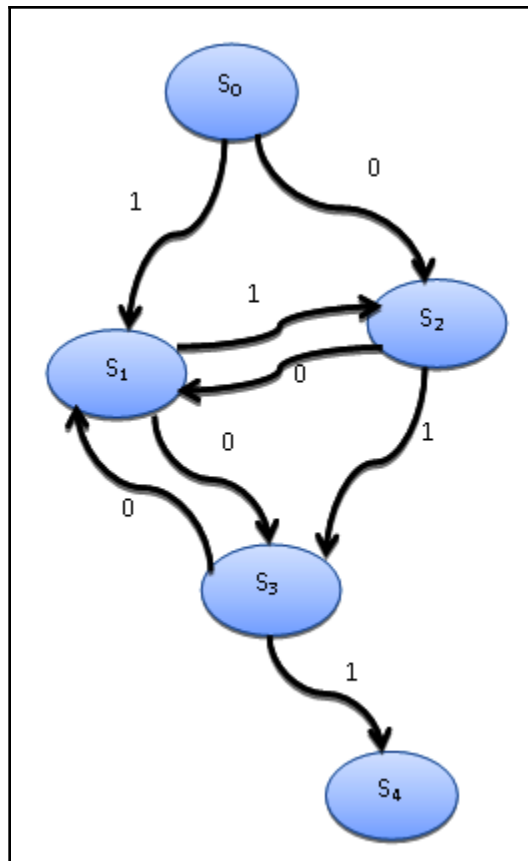
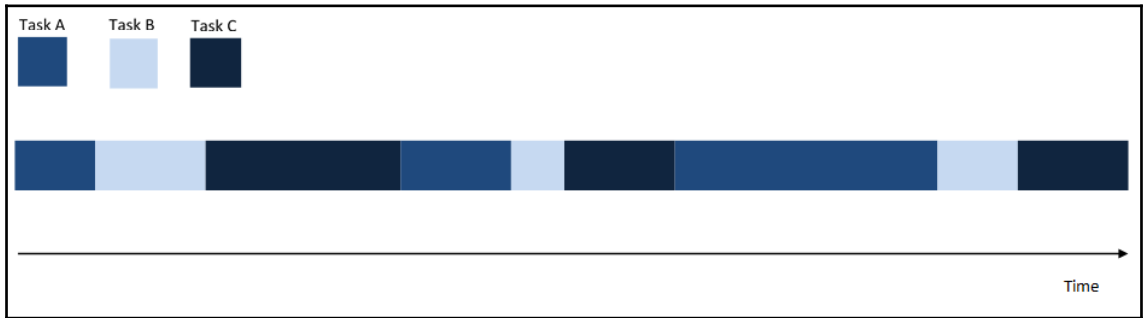




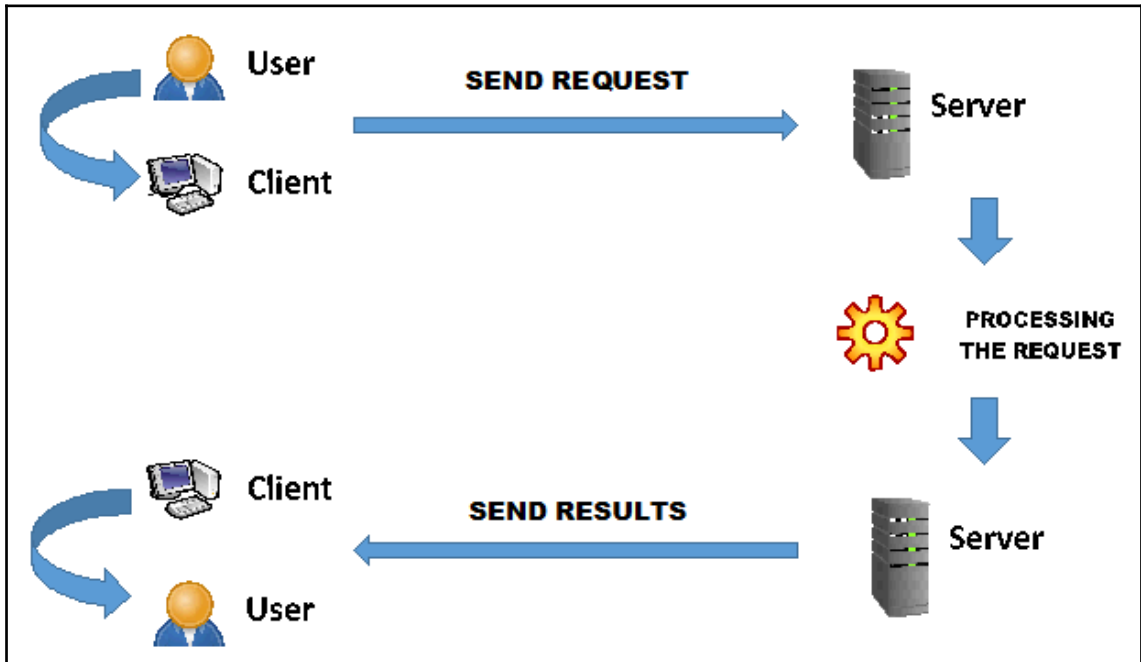
P_0	0	1	2	3	4	Alltoall	0	0	0	0	0
P_1	0	2	4	6	8		1	2	3	4	5
P_2	0	3	6	9	12		2	4	6	8	10
P_3	0	4	8	12	16		3	6	9	12	15
P_4	0	5	10	15	20		4	8	12	16	20

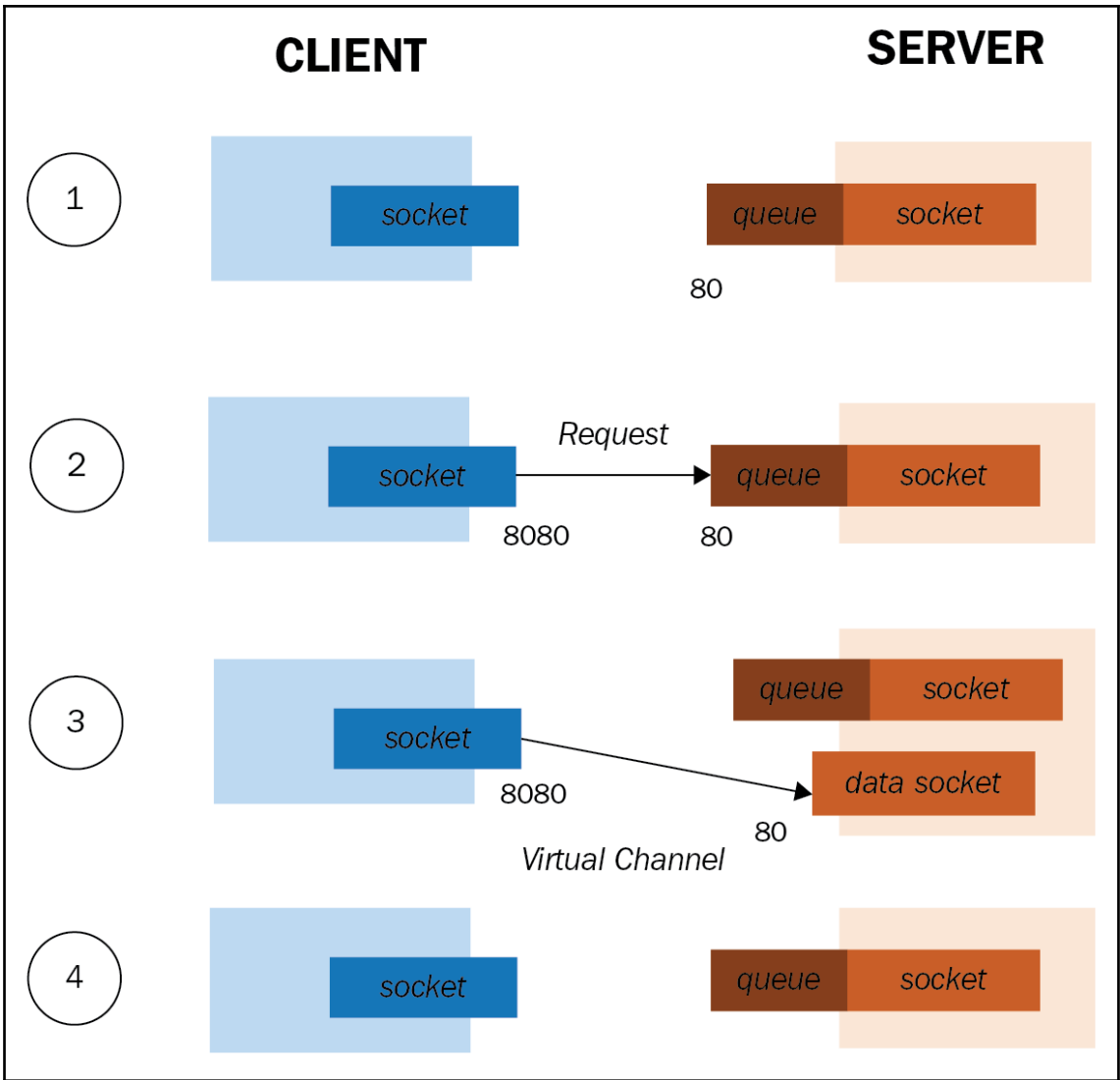


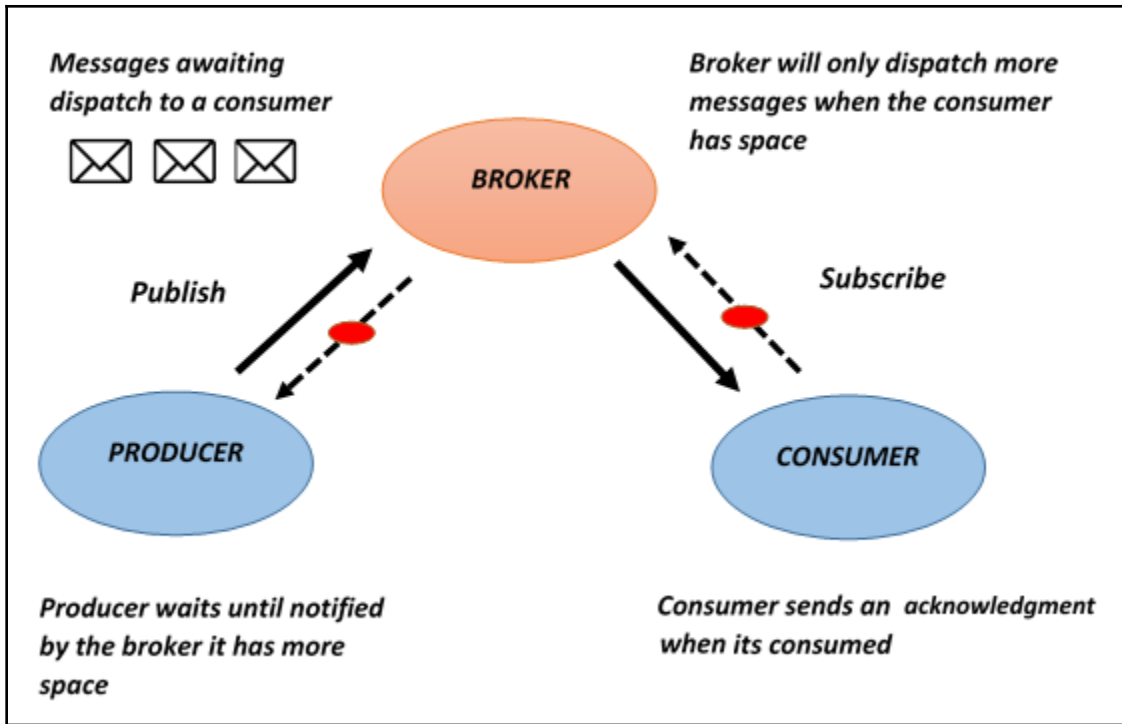
Chapter 5: Asynchronous Programming

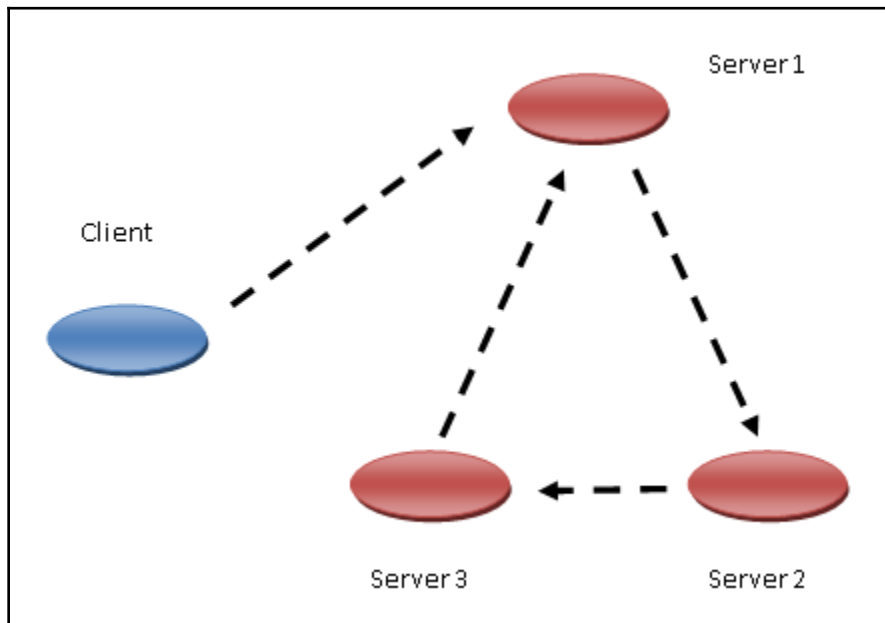
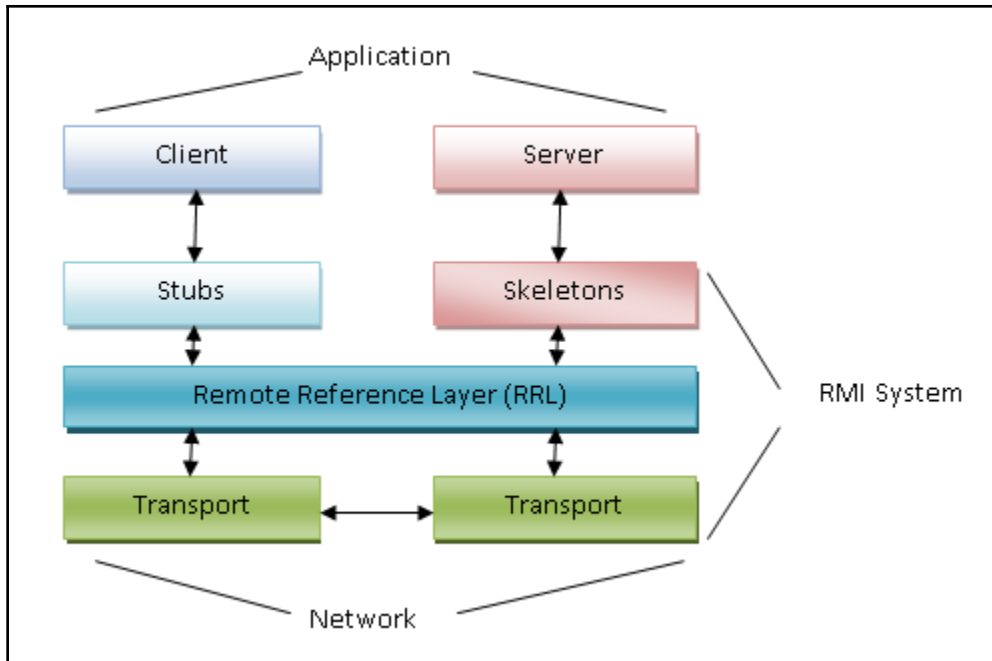


Chapter 6: Distributed Python

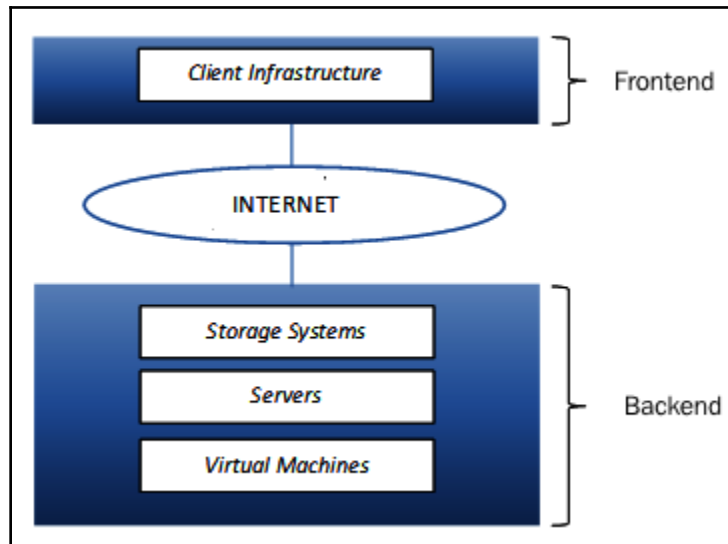
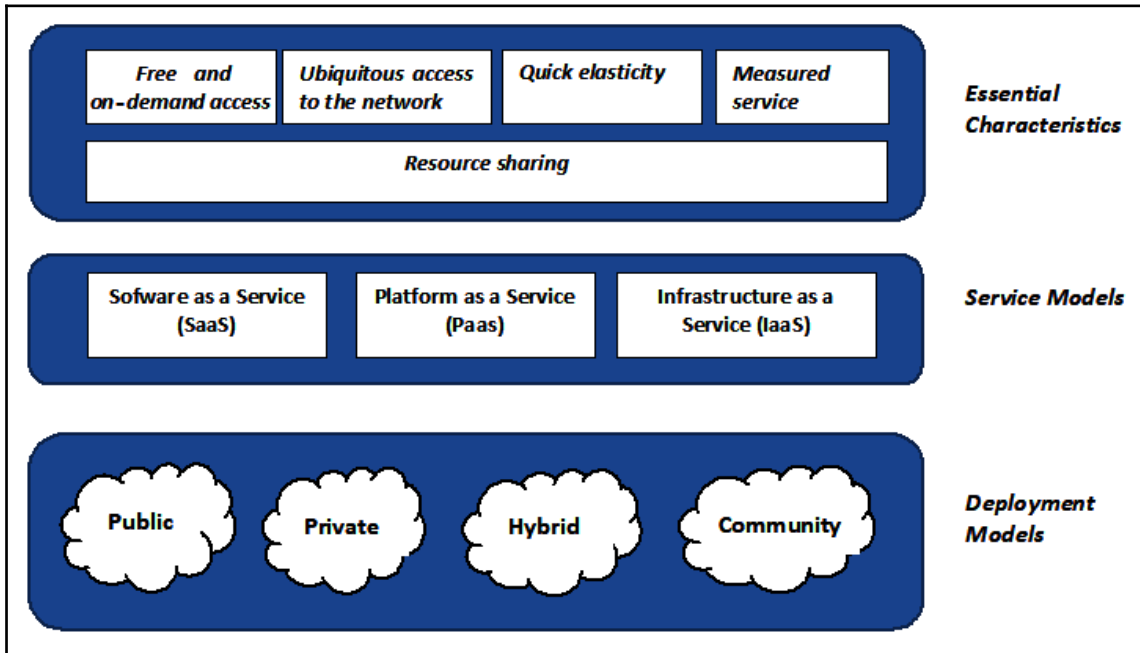








Chapter 7: Cloud Computing



Plans and pricing

Beginner: Free!

A limited account with one web app at `your-username.pythonanywhere.com`, restricted outbound Internet access from your apps, low CPU/bandwidth, no IPython/Jupyter notebook support.

It works and it's a great way to get started!

Create a Beginner account

Education accounts

Are you a teacher looking for a place your students can code Python? You're not alone. Click through to find out more about our Education beta.

All of our paid plans come with a no-quibble 30-day money-back guarantee — you're billed monthly and you can cancel at any time. The minimum contract length is just one month. You get unrestricted Internet access from your applications, unlimited in-browser Python, Bash and database consoles, and full SSH access to your account. All accounts (including free ones) have screen-sharing with other PythonAnywhere accounts, and free SSL support (though you'll need to get a certificate for your own domains).

Hacker \$5/month	Web dev \$12/month	Startup \$99/month	Custom \$5 to \$500/month
Run your Python code in the cloud from one web app and the console	If you want to host small Python-based websites for you or for your clients	Start a business and don't worry about having to scale to handle traffic spikes	Want a combination that's not on the list? Create your own! All custom plans have:
A Python IDE in your browser with unlimited Python/bash consoles	A Python IDE in your browser with unlimited Python/bash consoles	A Python IDE in your browser with unlimited Python/bash consoles	A Python IDE in your browser with unlimited Python/bash consoles

Send feedback Forums Help Blog Account Log out

pythonanywhere Dashboard Consoles Files Web Tasks Databases

Dashboard

Welcome, [giazax](#)

CPU Usage: 35% used – 35.34s of 100s. Resets in 2 hours, 55 minutes [More Info](#) [Upgrade Account](#)

File storage: 14% full – 70.6 MB of your 512.0 MB quota

Recent Consoles

You have no recent consoles.

[View all](#)

New console:

You can have up to 2 consoles. To get more, upgrade your account!

Recent Files

- /home/giazax/mysite/flask_app.py
- /home/giazax/pythoninthecloud/pytho...wsgi.py
- /home/giazax/pythoninthecloud/pytho...urls.py
- /home/giazax/pythoninthecloud/python in the cloud.py
- /var/www/giazax_pythonanywhere_com_wsgi.py

[+ Open another file](#) [Browse files](#)

Recent Notebooks

Your account does not support Jupyter Notebooks. [Upgrade your account](#) to get access!


All Web apps

[giazax.pythonanywhere.com](#)

[Open Web tab](#)

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 **pythonanywhere** [Dashboard](#) [Consoles](#) [Files](#) [Web](#) [Tasks](#) [Databases](#)

CPU Usage: 35% used – 35.34s of 100s. Resets in 2 hours, 40 minutes [More Info](#)

Start a new console:

Python: [3.7](#) / [3.6](#) / [3.5](#) / [3.4](#) / [2.7](#) | IPython: [3.7](#) / [3.6](#) / [3.5](#) / [3.4](#) / [2.7](#) | PyPy: [2.7](#)
Other: [Bash](#) | [MySQL](#)
Custom: [+](#)

Your consoles:

You have no consoles. Click a link above to start one.


Consoles shared with you

No-one has shared any consoles with you :-)

Running processes

[Fetch process list](#)

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 Python3.5 console 12254890 [Share with others](#) [☰](#)

```
Python 3.5.6 (default, Aug 22 2018, 20:43:34)
[GCC 5.4.0 20160609] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> 
```

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pythonanywhere Dashboard Consoles Files **Web** Tasks Databases

[Add a new web app](#)

You have no web apps

To create a PythonAnywhere-hosted web app, click the "Add a new web app" button to the left.

pythonanywhere Dashboard Consoles Files **Web** Tasks Databases

[Add a new web app](#)

Create new web app

Your web app's domain name

Your account doesn't support custom domain names, so your PythonAnywhere web app will live at `g1azax.pythonanywhere.com`.

Want to change that? [Upgrade now!](#)

Otherwise, just click "Next" to continue.

[Cancel](#) [« Back](#) [Next »](#)

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pythonanywhere Dashboard Consoles Files **Web** Tasks Databases

Add a new web app

Create new web app

Select a Python Web framework

...or select "Manual configuration" if you want detailed control.

- » Django
- » web2py
- » Flask
- » Bottle
- » Manual configuration (including virtualenvs)

What other frameworks should we have here? Send us some feedback using the link at the top of the page!

Cancel « Back Next »

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pythonanywhere Dashboard Consoles Files **Web** Tasks Databases

Add a new web app

Create new web app

Select a Python version

- » Python 2.7 (Flask 1.0.2)
- » Python 3.4 (Flask 1.0.2)
- » Python 3.5 (Flask 1.0.2)
- » Python 3.6 (Flask 1.0.2)
- » Python 3.7 (Flask 1.0.2)

Note: If you'd like to use a different version of Flask to the default version, you can use a virtualenv for your web app. There are [instructions here](#).

Cancel « Back Next »

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pythonanywhere Dashboard Consoles Files **Web** Tasks Databases

[Add a new web app](#)

Create new web app ✕

Quickstart new Flask project

Enter a path for a Python file you wish to use to hold your Flask app. **If this file already exists, its contents will be overwritten with the new app.**

Path

Cancel
« Back
Next »

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pythonanywhere Dashboard Consoles Files **Web** Tasks Databases

All done! Your web app is now set up. Details below. ✕

[giazax.pythonanywhere.com](#)

[Add a new web app](#)

Configuration for giazax.pythonanywhere.com

Reload:

↻ Reload giazax.pythonanywhere.com

Best before date:

We're happy to host your free website – and keep it free – for as long as you want to keep it running, but you'll need to log in at least once every three months and click the "Run until 3 months from today" button below. We'll send you an email a week before the site is disabled so that you don't forget to do that. [See here for more details.](#)

This site will be disabled on **Sunday 14 July 2019**

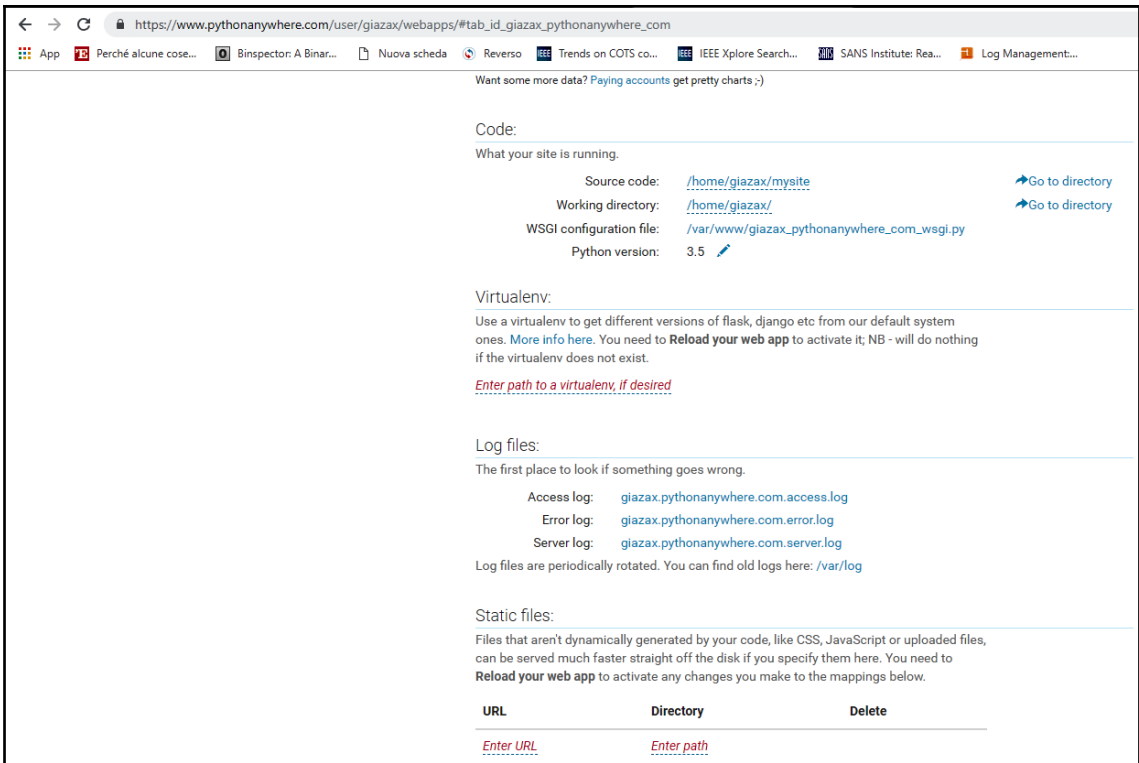
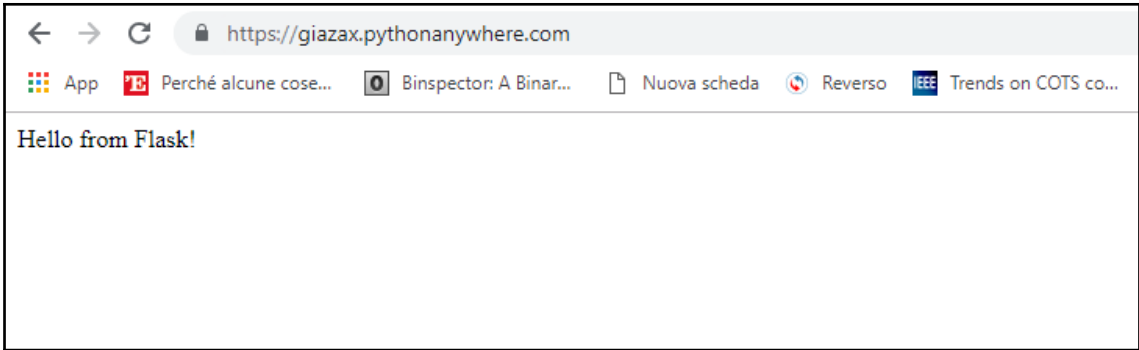
Run until 3 months from today

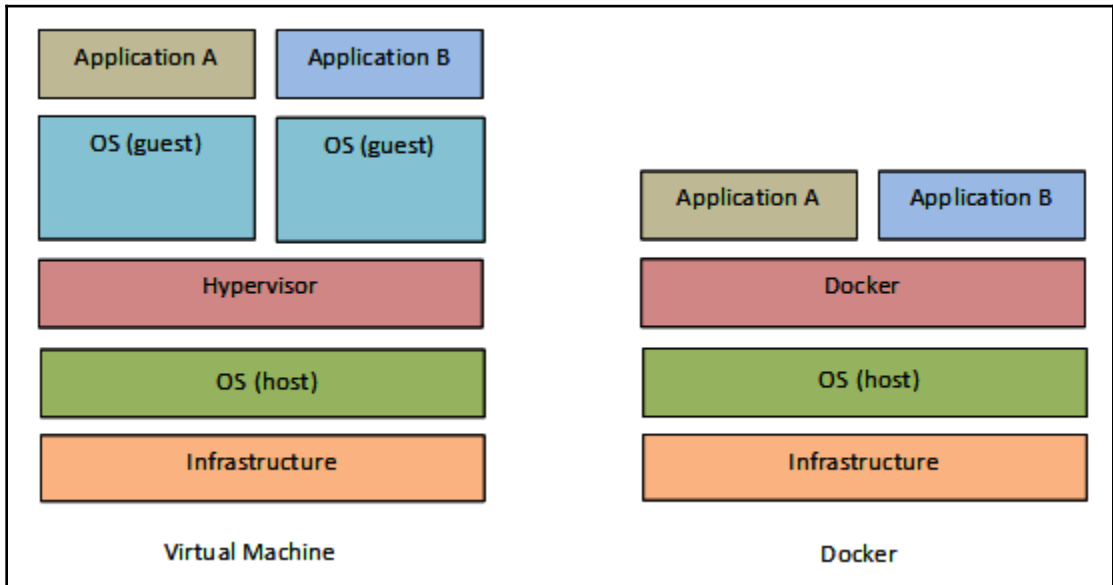
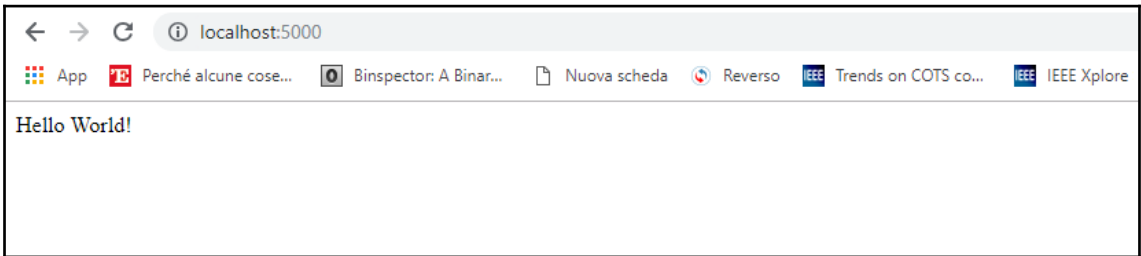
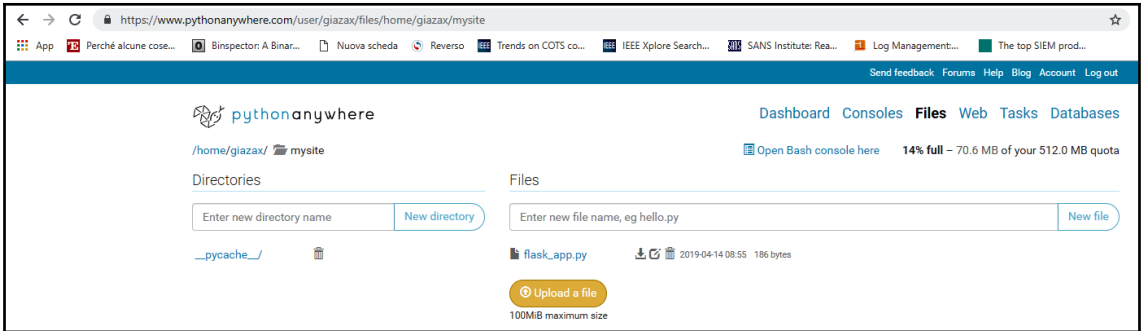
[Paying users'](#) sites stay up forever without any need to log in to keep them running.

Traffic:

How busy is your site?

This month (previous month)	38	(0)	
Today (yesterday)	1	(37)	





← → ↻ 🔒 https://us-east-2.console.aws.amazon.com/console/home?region=us-east-2#

AWS management console

AWS services

Find services
You can enter names, keywords or acronyms.

▼ Recently visited services

- Billing

▼ AWS services

<ul style="list-style-type: none"> Calculation EC2 Lightsail ECR ECS EKS Lambda Batch Elastic Beanstalk Serverless Application 	<ul style="list-style-type: none"> Management and governance AWS Organizations CloudWatch AWS Auto Scaling CloudFormation CloudTrail Config OpsWorks Service Catalog 	<ul style="list-style-type: none"> AWS Cost management AWS Cost Explorer AWS Budgets AWS Marketplace Subscriptions 	<ul style="list-style-type: none"> Mobile devices AWS Amplify Mobile Hub
---	---	--	---

Access to resources on the move

Access the management console using the AWS Console mobile app. [Further information](#)

Exploration of AWS

Open a distribution for Elasticsearch

A completely open source distribution, led by the Elasticsearch community, with security features and company-wide alert. [More information](#)


AWS Marketplace

Find, buy and distribute popular software products on AWS. [Further information](#)

Amazon RDS

Configure, use and resize your relational database in the

AWS Services Edit AWS User N. Virginia Support




AWS Lambda

AWS Lambda is a compute service that runs developers' code in response to events and automatically manages the compute resources for them, making it easy to build applications that respond quickly to new information.


[Get Started Now](#)

Learn more about AWS Lambda



Respond quickly to new information


AWS Lambda runs your code in response to events such as image uploads, in-app activity, website clicks, or outputs from connected devices. You can use AWS Lambda to add custom logic to other AWS services or create your own backend service that operates at AWS scale, performance, and security.



Run your code without managing infrastructure

AWS Lambda administers the underlying compute resources, including server and operating system maintenance, capacity provisioning, automatic scaling, code monitoring, logging, and code and security patch deployment.

All you need to do is write the code.



Cost-effective and efficient

AWS Lambda runs your code only when needed, with no unnecessary overhead or cost.

AWS Lambda Documentation and Support

[Getting Started Guide](#) | [Documentation](#) | [Support](#) | [Forums](#)

AWS Services Edit AWS User N. Virginia Support

Lambda > New function using blueprint hello-world-python

Step 1: Select blueprint

Step 2: Configure function

Step 3: Review

Configure function

A Lambda function consists of the custom code you want to execute. [Learn more](#) about Lambda functions.

Name* hello-world-python

Description A starter AWS Lambda function.

Runtime* Python 2.7

Lambda function code

Provide the code for your function. Use the editor if your code does not require custom libraries (other than boto3). If you need custom libraries, you can upload your code and libraries as a .ZIP file.

Code entry type Edit code inline Upload a .ZIP file Upload a .ZIP from Amazon S3

```
1 from __future__ import print_function
2
3 import json
4
5 print('Loading function')
6
7
8 def lambda_handler(event, context):
9     #print("Received event: " + json.dumps(event, indent=2))
10    print("value1 = " + event['key1'])
11    print("value2 = " + event['key2'])
12    print("value3 = " + event['key3'])
13    return event['key1'] # Echo back the first key value
14    #raise Exception('Something went wrong')
```

Lambda function handler and role

Handler* lambda_function.lambda_handler ⓘ

Role* lambda_basic_execution ⓘ

Ensure that popups are enabled to create a new role. [Learn more](#) about Lambda execution roles.

Advanced settings

AWS Lambda requires access to your resources

AWS Lambda uses an IAM role that grants your custom code permissions to access AWS resources it needs.

▼ Hide Details

Role Summary ⓘ

Role Lambda execution role permissions

Description

IAM Role Create a new IAM Role ▼

Role Name lambda_basic_execution

▶ View Policy Document

Don't Allow **Allow**

Lambda > New function using blueprint hello-world-python

Step 1: Select blueprint
Step 2: Configure function
Step 3: Review

Review

Please review your Lambda function details. You can go back to edit changes for each section. When you are ready, click **Create function** to complete the setup process.

Lambda function Edit

Name	hello-world-python
Description	A starter AWS Lambda function.
Runtime	Python 2.7
Handler	lambda_function.lambda_handler
Role	lambda_basic_execution
Memory (MB)	128
Timeout	3

Cancel Previous **Create function**

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AWS Services Edit

AWS User N. Virginia Support

Lambda > Functions > hello-world-python ARN - arn:aws:lambda:us-east-1:628746249777:function:hello-world-python

Test Actions

Congratulations! Your Lambda function "hello-world-python" has been successfully created.

Code Configuration Event sources API endpoints Monitoring

Code entry type Edit code inline Upload a .ZIP file Upload a .ZIP from Amazon S3

```
1 from __future__ import print_function
2
3 import json
4
5 print('Loading function')
6
7
8 def lambda_handler(event, context):
9     #print("Received event: " + json.dumps(event, indent=2))
10    print("value1 = " + event['key1'])
11    print("value2 = " + event['key2'])
12    print("value3 = " + event['key3'])
13    return event['key1'] # Echo back the first key value
14    #raise Exception('Something went wrong')
```

Feedback English

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Input test event

It looks like you have not configured a test event for this function yet. Use the editor below to enter an event to test your function with (please remember that this will actually execute the code!). You can always edit the event later by choosing **Configure test event** in the Actions list. Note that changes to the event will only be saved locally.

Sample event template

Hello World

```
1 - {  
2   "key3": "value3",  
3   "key2": "value2",  
4   "key1": "value1"  
5 }
```

Cancel

Save

Save and test

✔ Execution result: succeeded (logs)
 The area below shows the result returned by your function execution.

```
"hello, world!"
```

Summary

Code SHA 256 j3x8AeuD7gdjpESGMi91Ps2d1cWSSzlvf
cJZ2AkEovv=

Request ID a2b6e0e5-e7bc-11e5-b30a-
7d151ecbe64d

Duration 0.27 ms

Billed duration 100 ms

Resources configured 128 MB

Max memory used 9 MB

Log output

The area below shows the logging calls in your code. These correspond to a single row within the CloudWatch log group corresponding to this Lambda function. [Click here](#) to view the CloudWatch log group.

```
START RequestId: a2b6e0e5-e7bc-11e5-b30a-7d151ecbe64d Version: SLATEST
value1 = hello, world!
value2 = value2
value3 = value3
END RequestId: a2b6e0e5-e7bc-11e5-b30a-7d151ecbe64d
REPORT RequestId: a2b6e0e5-e7bc-11e5-b30a-7d151ecbe64d Duration: 0.27 ms Billed Duration: 100 ms Memory Size: 128 MB Max Memory Used: 9 MB
```

Lambda > Functions > hello-world-python ARN - arn:aws:lambda:us-east-1:628746249777:function:hello-world-python

Test
Actions ▾

Code
Configuration
Event sources
API endpoints
Monitoring
?

CloudWatch metrics at a glance (last 24 hours) [View logs in CloudWatch](#)

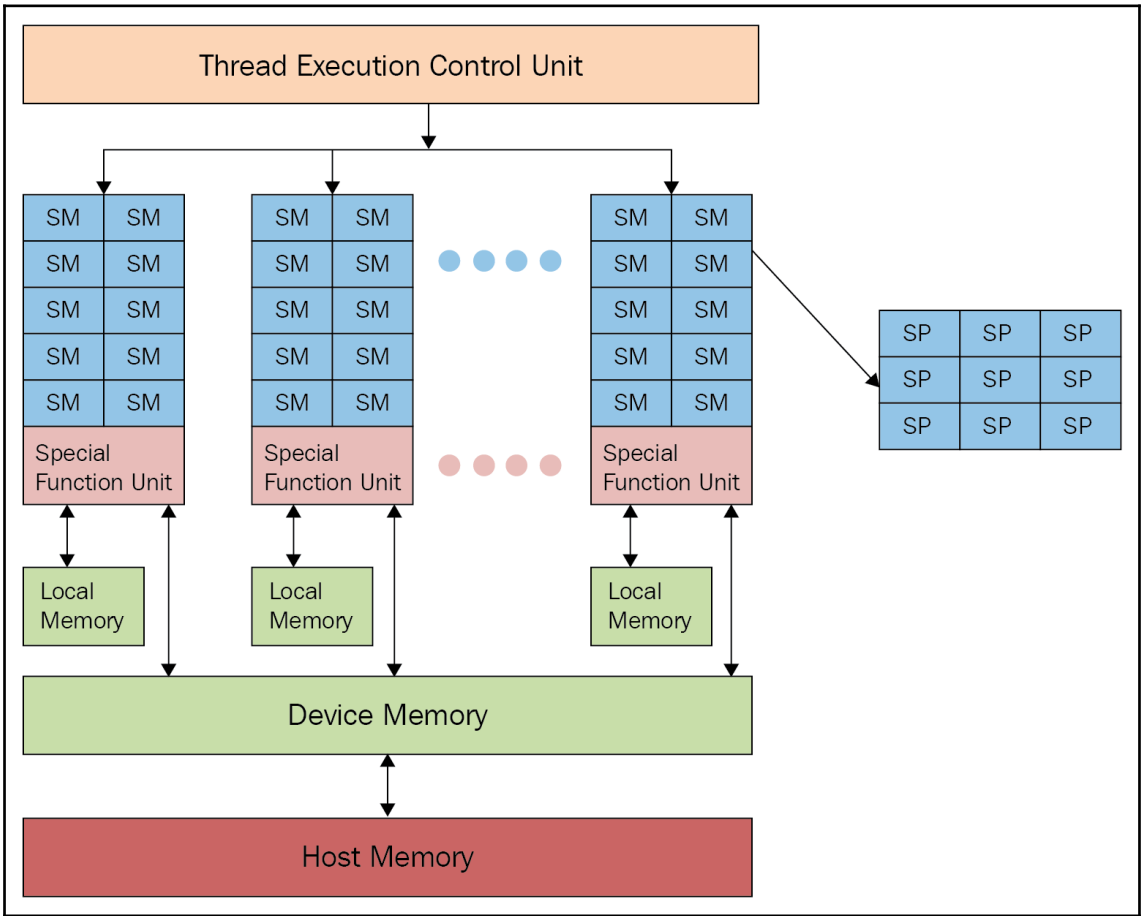
Invocation count ↻

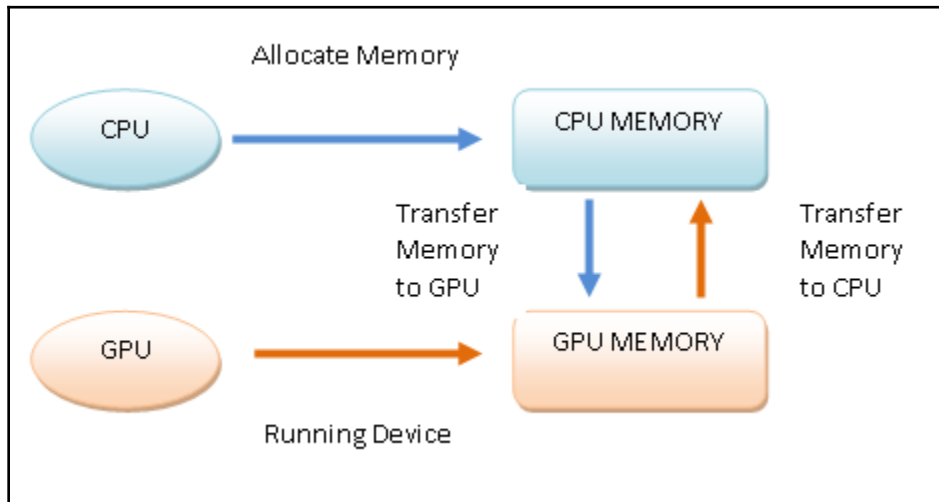
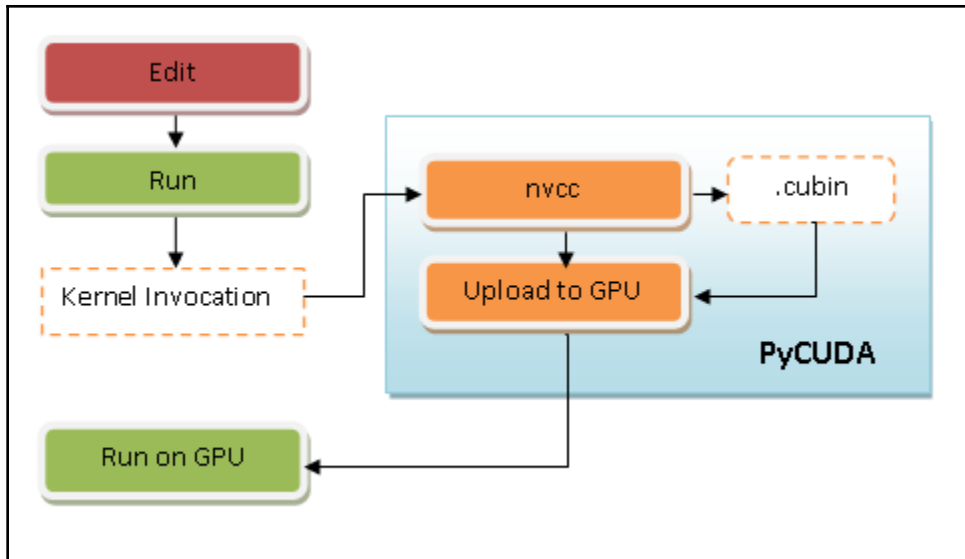
Invocation duration ↻

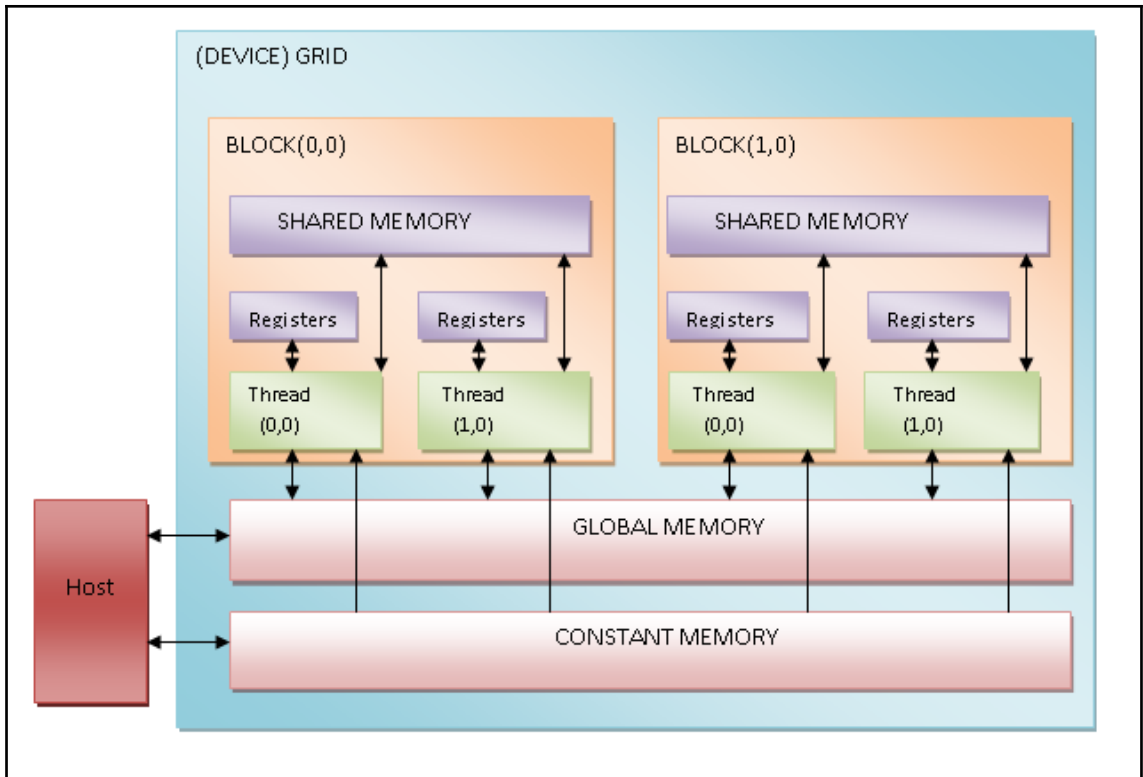
Invocation errors ↻

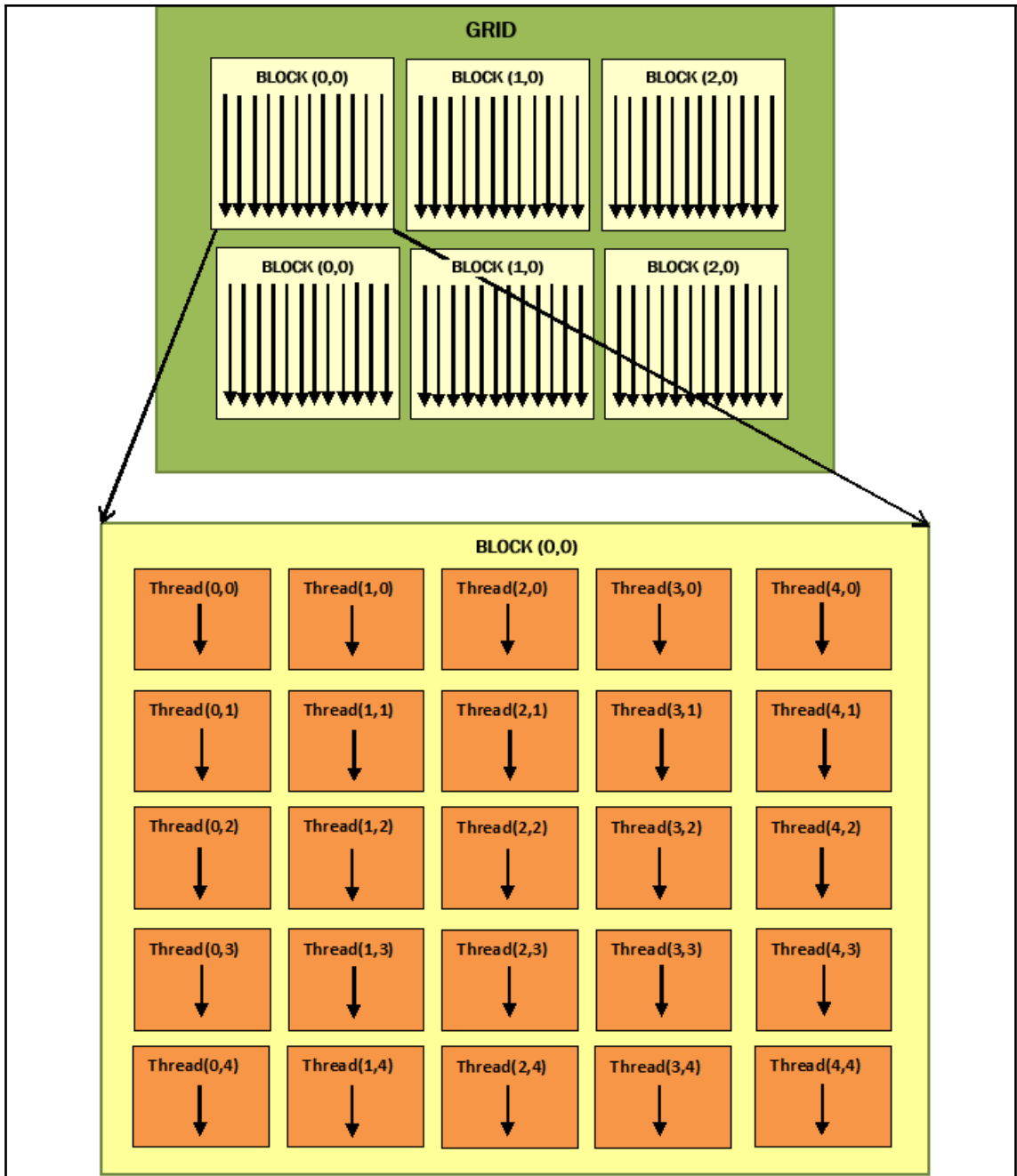
Throttled invocations ↻

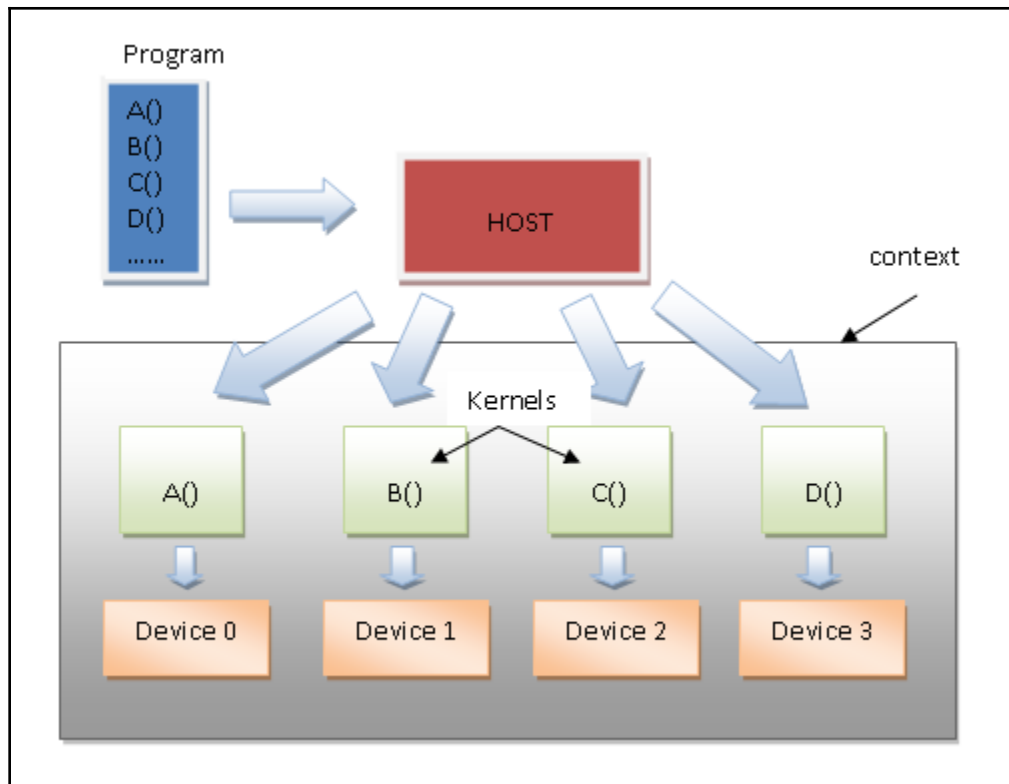
Chapter 8: Heterogeneous Computing

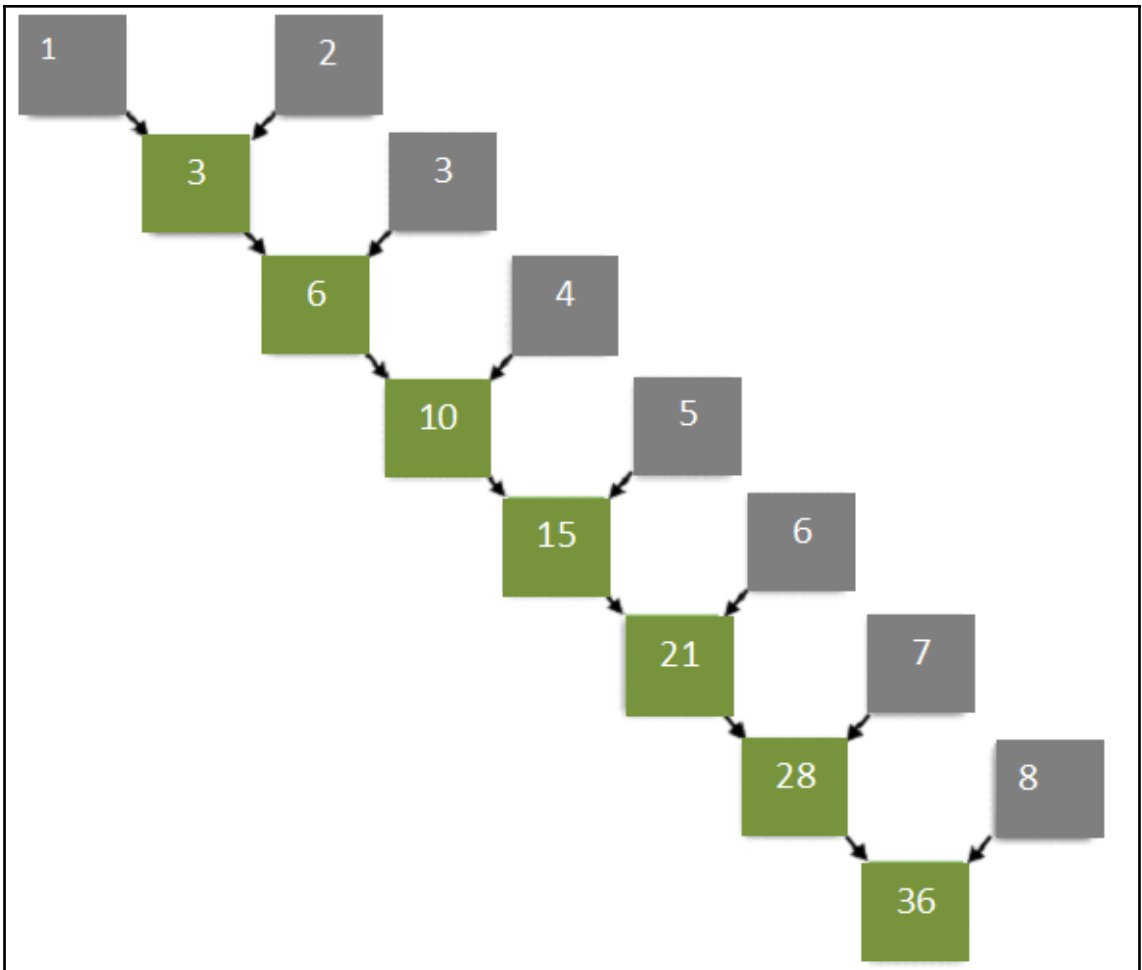


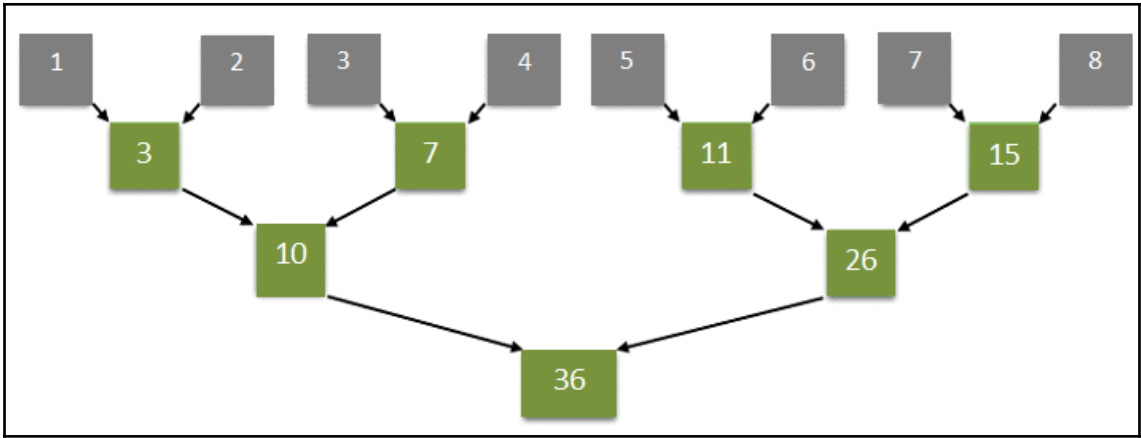




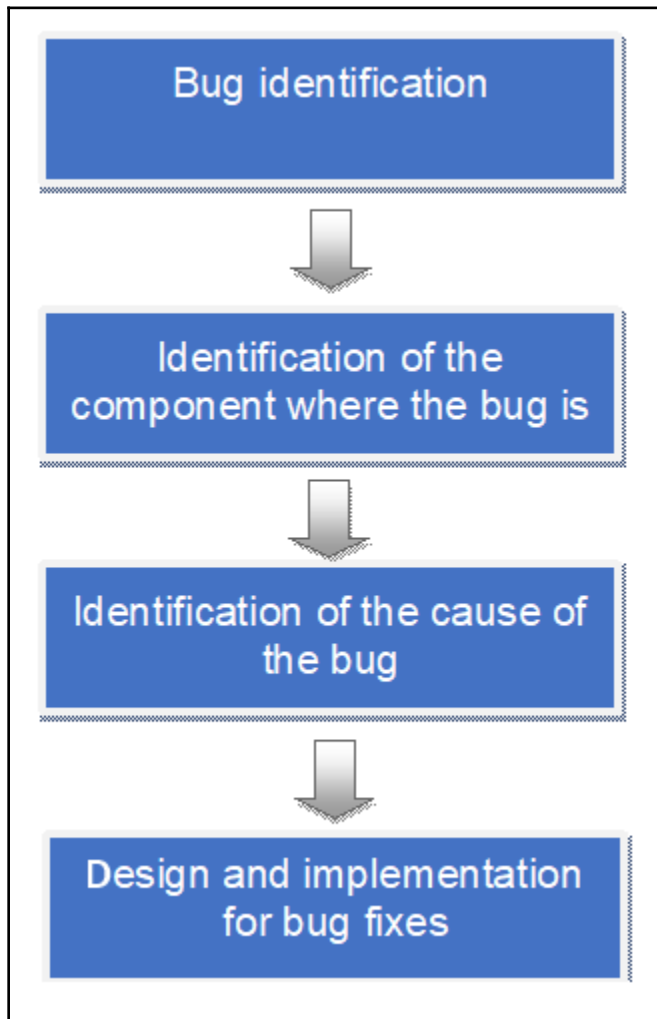


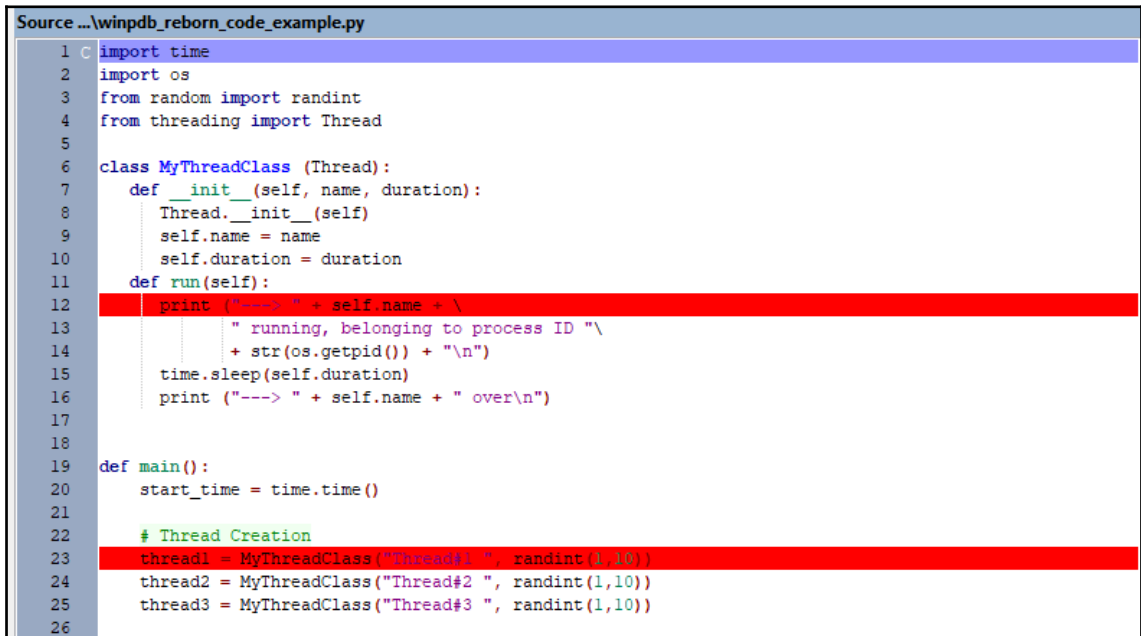
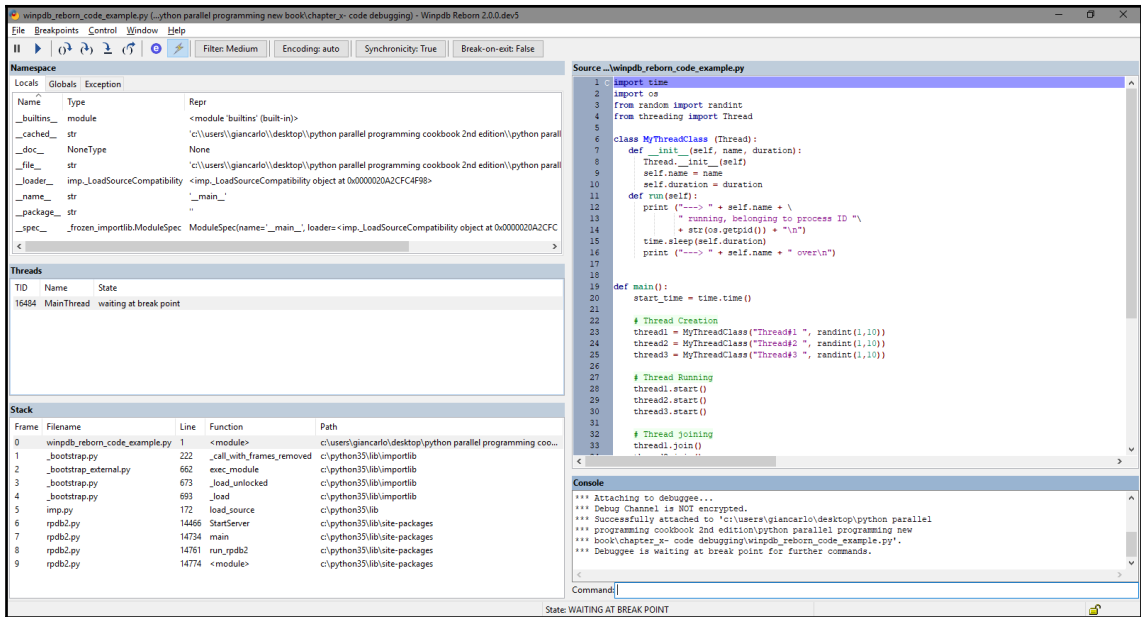






Chapter 9: Python Debugging and Testing





winpdb_reborn_code_example.py (...python parallel programming new book\chapter_x- code debugging) - Winpdb Reborn 2.0.0.dev5

File Breakpoints Control Window Help

Filter: Medium Encoding: auto Synchronicity: True Break-on-exit: False

Namespace

Name	Type	Repr
self	__main__.MyThreadClass	<MyThreadClass(Thread#1, started 9592)>

```
Source ...\winpdb_reborn_code_example.py
1 import time
2 import os
3 from random import randint
4 from threading import Thread
5
6 class MyThreadClass (Thread):
7     def __init__(self, name, duration):
8         Thread.__init__(self)
9         self.name = name
10        self.duration = duration
11    def run(self):
12        print ("---> " + self.name + \
13              " running, belonging to process ID "\
14              + str(os.getpid()) + "\n")
15        time.sleep(self.duration)
16        print ("---> " + self.name + " over\n")
17
18
19 def main():
20     start_time = time.time()
21
22     # Thread Creation
23     thread1 = MyThreadClass("Thread#1 ", randint(1,10))
24     thread2 = MyThreadClass("Thread#2 ", randint(1,10))
25     thread3 = MyThreadClass("Thread#3 ", randint(1,10))
26
27     # Thread Running
28     thread1.start()
29     thread2.start()
30     thread3.start()
31
32     # Thread joining
33     thread1.join()
```

```
Source c:\python35\lib\threading.py
810     # private! Called by _after_fork() to reset our internal locks as
811     # they may be in an invalid state leading to a deadlock or crash.
812     self._started._reset_internal_locks()
813     if is_alive:
814         self._set_tstate_lock()
815     else:
816         # The thread isn't alive after fork: it doesn't have a tstate
817         # anymore.
818         self._is_stopped = True
819         self._tstate_lock = None
820
821     def __repr__(self):
822         assert self._initialized, "Thread.__init__() was not called"
823         status = "initial"
824         if self._started.is_set():
825             status = "started"
826         self.is_alive() # easy way to get ._is_stopped set when appropriate
827         if self._is_stopped:
828             status = "stopped"
829         if self._daemonic:
830             status += " daemon"
831         if self._ident is not None:
832             status += " %s" % self._ident
833         return "<%(%(s, %s)>" % (self.__class__.__name__, self.name, status)
834
835     def start(self):
836         """Start the thread's activity.
837
838         It must be called at most once per thread object. It arranges for the
839         object's run() method to be invoked in a separate thread of control.
840
841         This method will raise a RuntimeError if called more than once on the
842         same thread object.
```

```
C:\Windows\system32\cmd.exe
C:\Users\Administrator>dism /online /Enable-Feature /FeatureName:TelnetClient
Deployment Image Servicing and Management tool
Version: 10.0.14393.0
Image Version: 10.0.14393.2457
Enabling feature(s)
[=====100.0%=====]
The operation completed successfully.
C:\Users\Administrator>_
```

```
C:\Windows\System32\telnet.exe
Welcome to Microsoft Telnet Client
Escape Character is 'CTRL+]'
Microsoft Telnet>
```

```
Telnet localhost
> c:\users\giancarlo\desktop\python parallel programming cookbook 2nd edition\python parallel
programming new book\chapter_x- code debugging\rpdb_code_example.py(7)<module>()
-> def my_func(thread_number):
(Pdb)
```

```
Telnet 127.0.0.1
(Pdb) list
 2     import rpdb
 3
 4     debugger = rpdb.Rpdb(port=4444)
 5     rpdb.Rpdb().set_trace()
 6
 7 -> def my_func(thread_number):
 8     return print('my_func called by thread N{}'.format(thread_number))
 9
10     def main():
11         threads = []
12         for i in range(10):
(Pdb)
```