

# **PuRo Mail Server**

A mail server based on Amazon Web  
Service

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# Descrizione servizio realizzato

## AWS

- Elastic Compute Cloud (EC2)
  - Auto Scaling
- DynamoDB
- Simple Storage Service (S3)
- Elastic Load Balancing
- CloudWatch
- Route 53

## Software Testing

- GreenMail: Server SMTP, IMAP, POP3
- Postal: testing SMTP
- Rabid: testing POP3
- Thunderbird: testing SMTP/s, POP3/s
- Telnet: testing SMTP, POP3

## Protocolli Analizzati

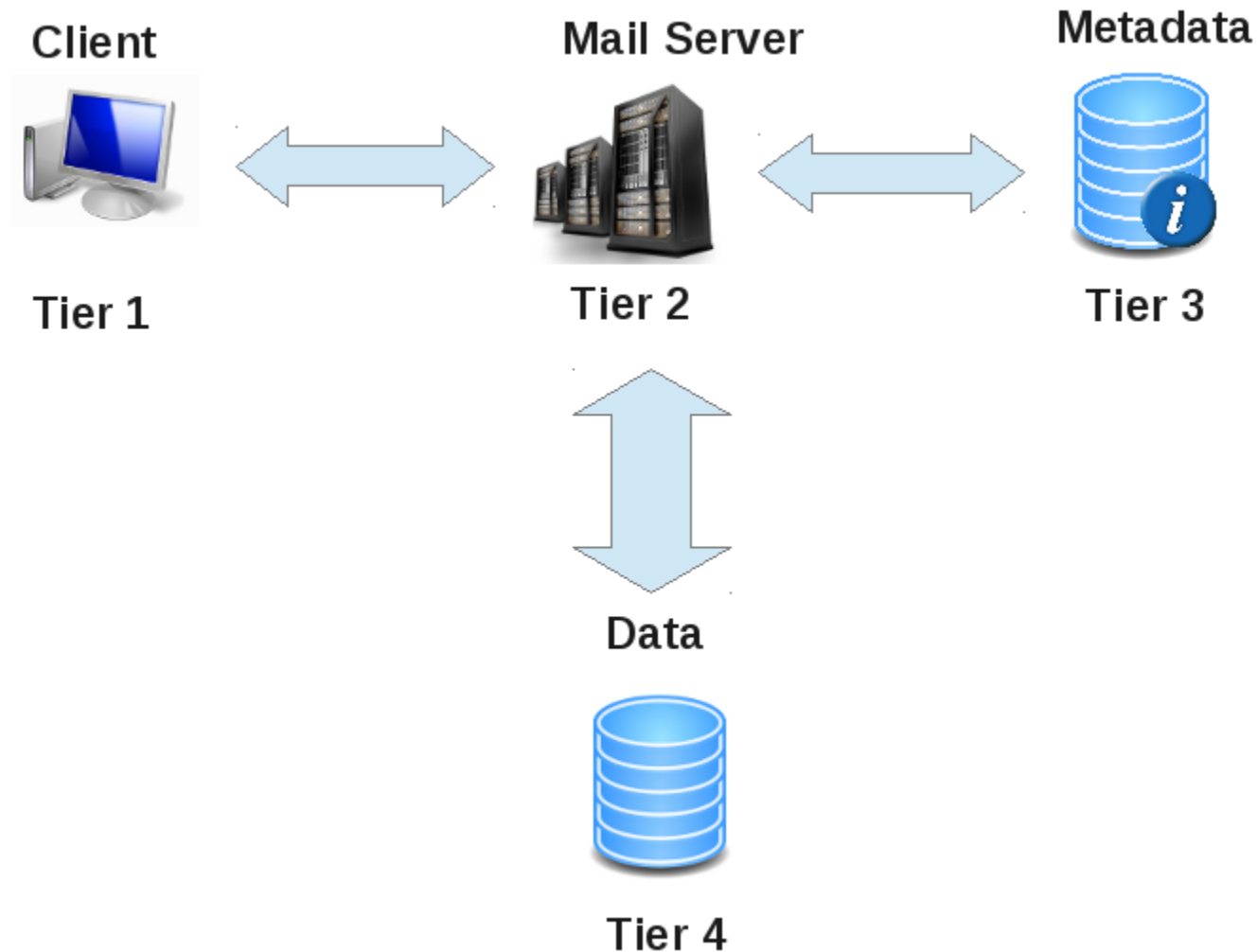
- Smtip
- Pop3
- Imap



## Protocolli Implementati

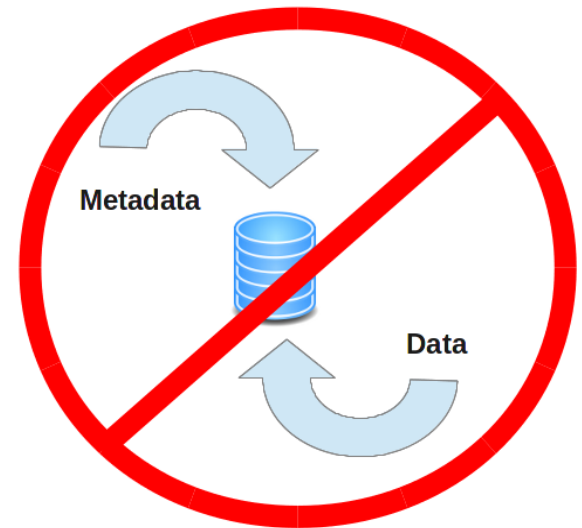
- Smtip
- Pop3

# Architettura generale

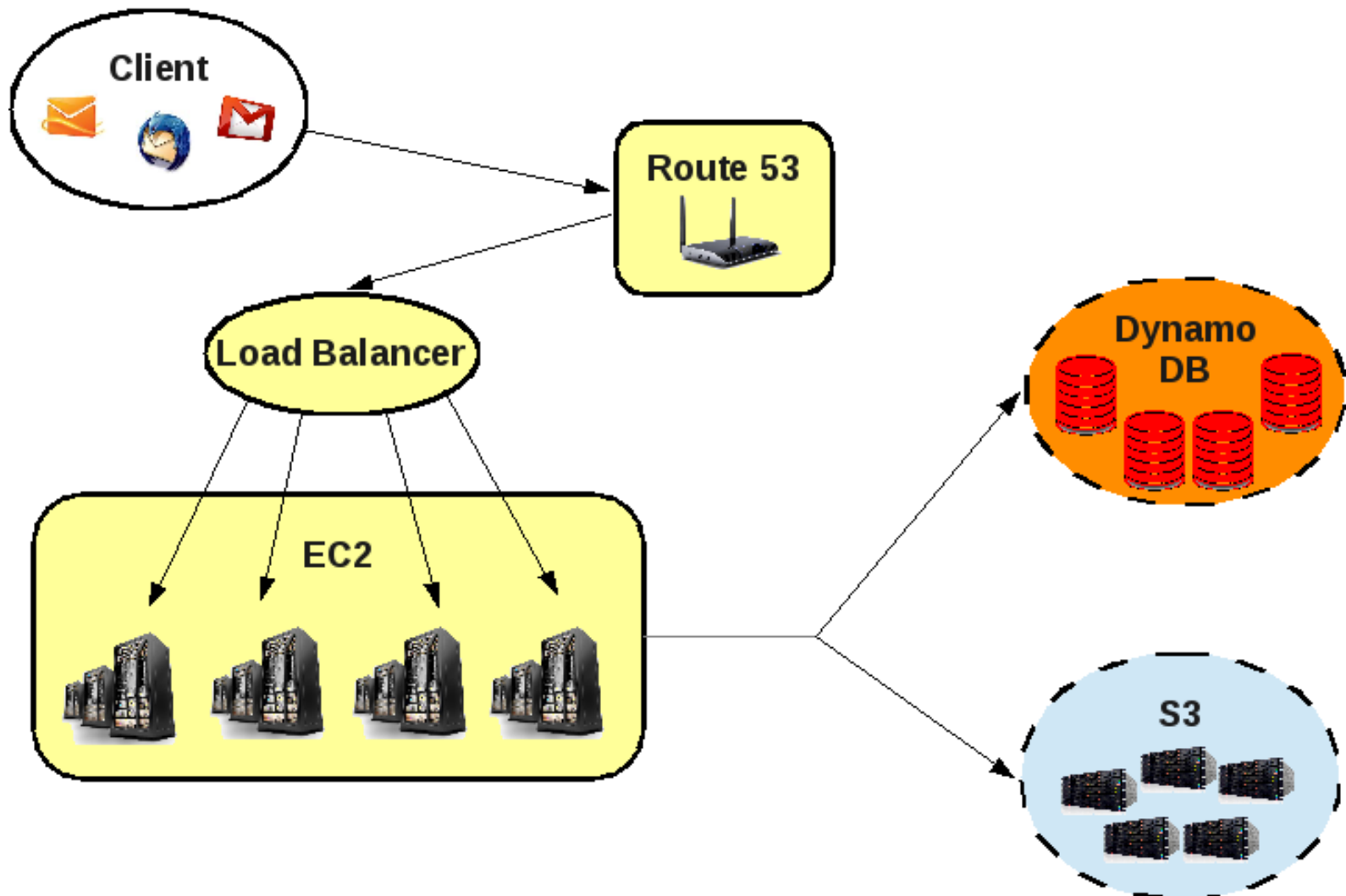


# Motivazioni four tier

- Perché non Metadati e Dati su DynamoDB?
  - Poco spazio (64 KB per item)
- Perché non Metadati e Dati su S3?
  - Soluzione poco pulita
  - Impossibile recuperare singolo metadato
- Vantaggi divisione Metadati - Dati
  - Buona divisione della logica
  - Possibilità di scaricare solo informazioni ricercate



# Architettura dettagliata



# Tier 1 - User Agent



Server	Porta
SMTP	12365 (o 25)
SMTPS	12366
POP3	12450
POP3S	12451

Indirizzo di configurazione: [puro-mail.tk](http://puro-mail.tk)

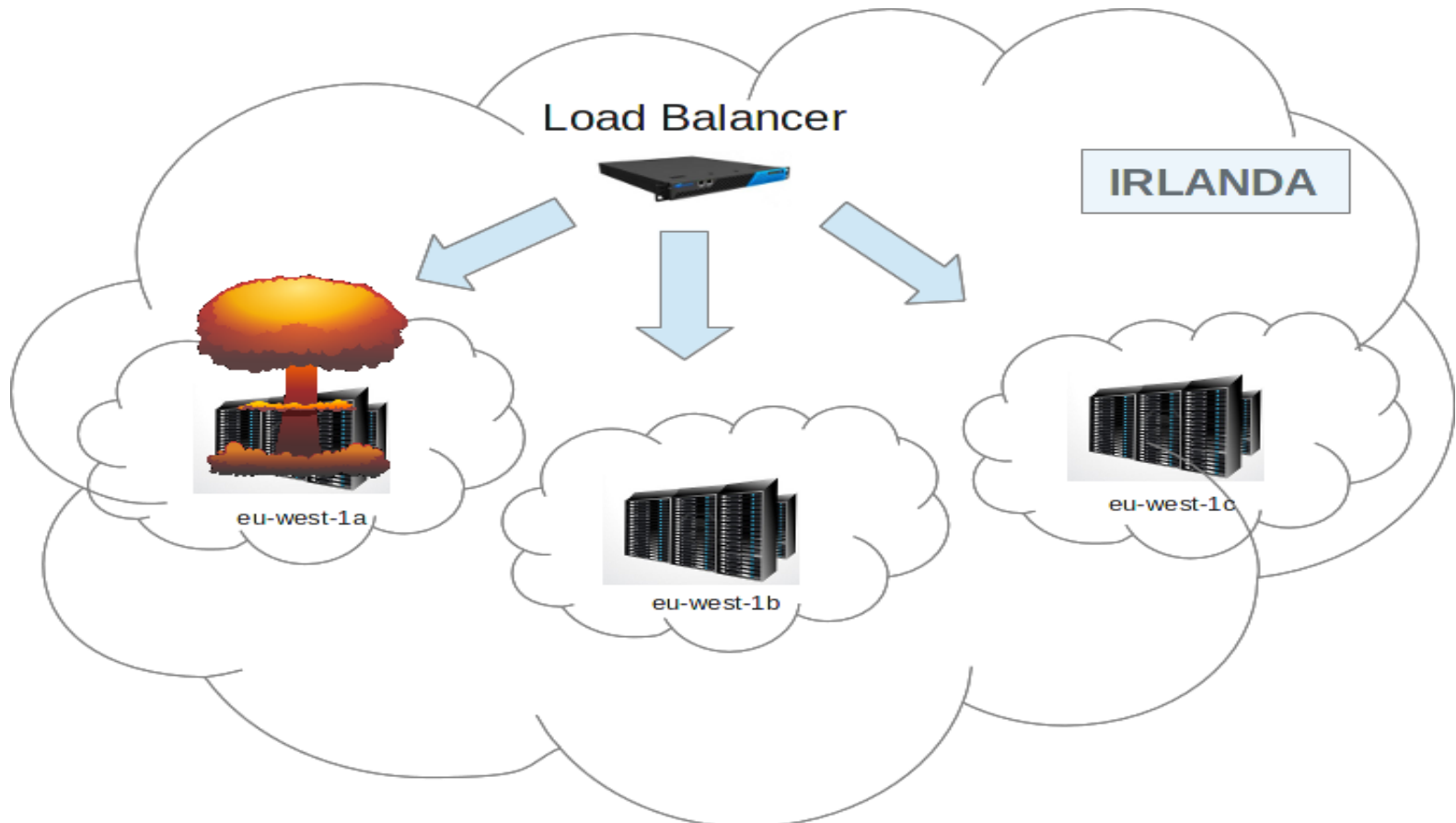
# Tier 2 - Route 53

- Servizio DNS altamente scalabile e disponibile
- Record Set:

	Name	Type	Value
<input type="checkbox"/>	puro-mail.tk.	A	ALIAS puroloadbalancer-1038931276.eu-west-1.elb.amazonaws.com. (z3nf1z3nom5oy2)
<input type="checkbox"/>	puro-mail.tk.	MX	10 puro-mail.tk
<input type="checkbox"/>	puro-mail.tk.	NS	ns-1723.awsdns-23.co.uk. ns-76.awsdns-09.com. ns-872.awsdns-45.net. ns-1458.awsdns-54.org.
<input type="checkbox"/>	puro-mail.tk.	SOA	ns-1723.awsdns-23.co.uk. awsdns-hostmaster.amazon.com. 1 7200 900 1209600 86400

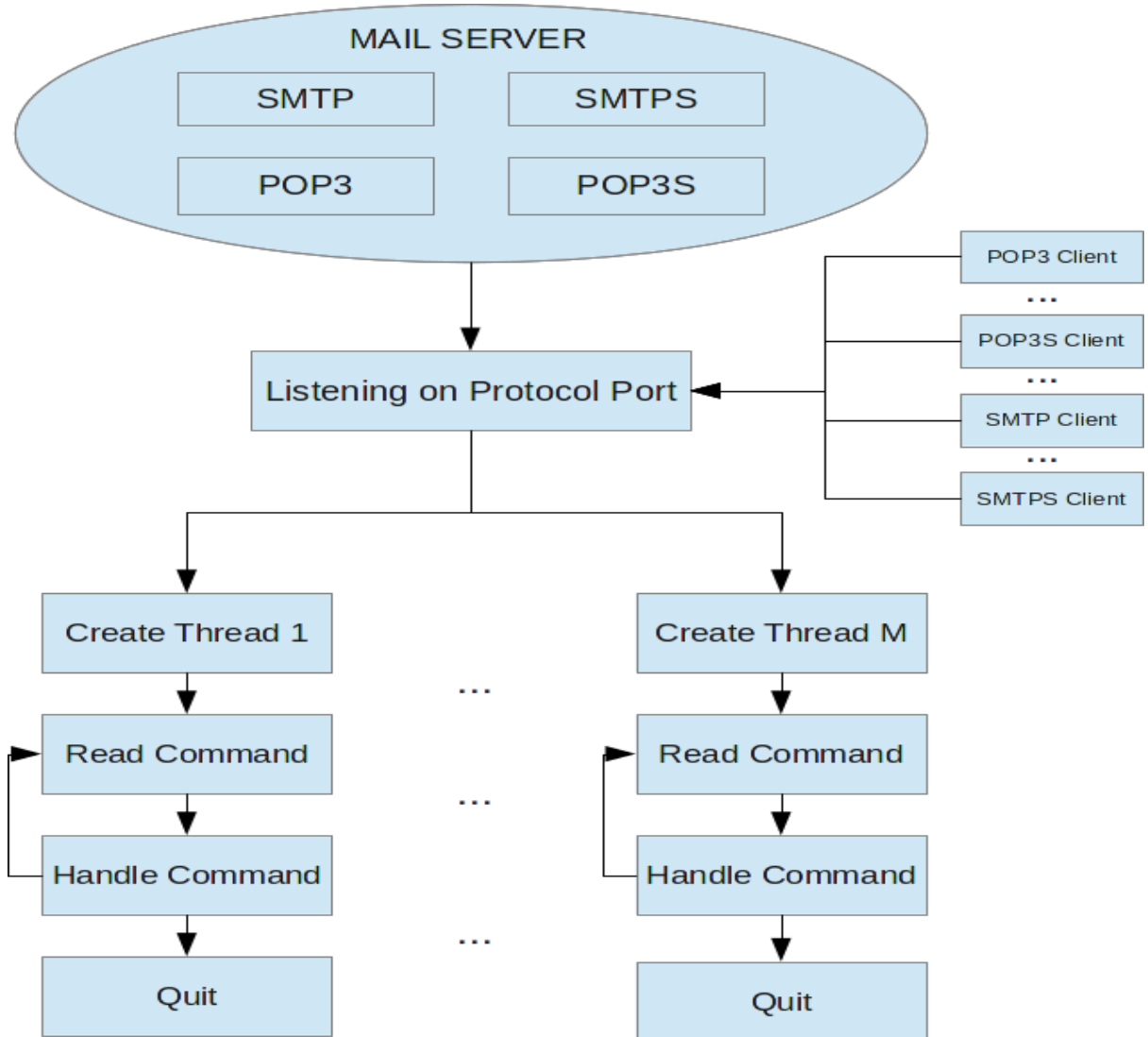
# Tier 2 - Load Balancer

- Load balancer:
  - Carico equamente distribuito tra **availability zone**
  - Distribuzione tra availability zone → tollerante ai guasti



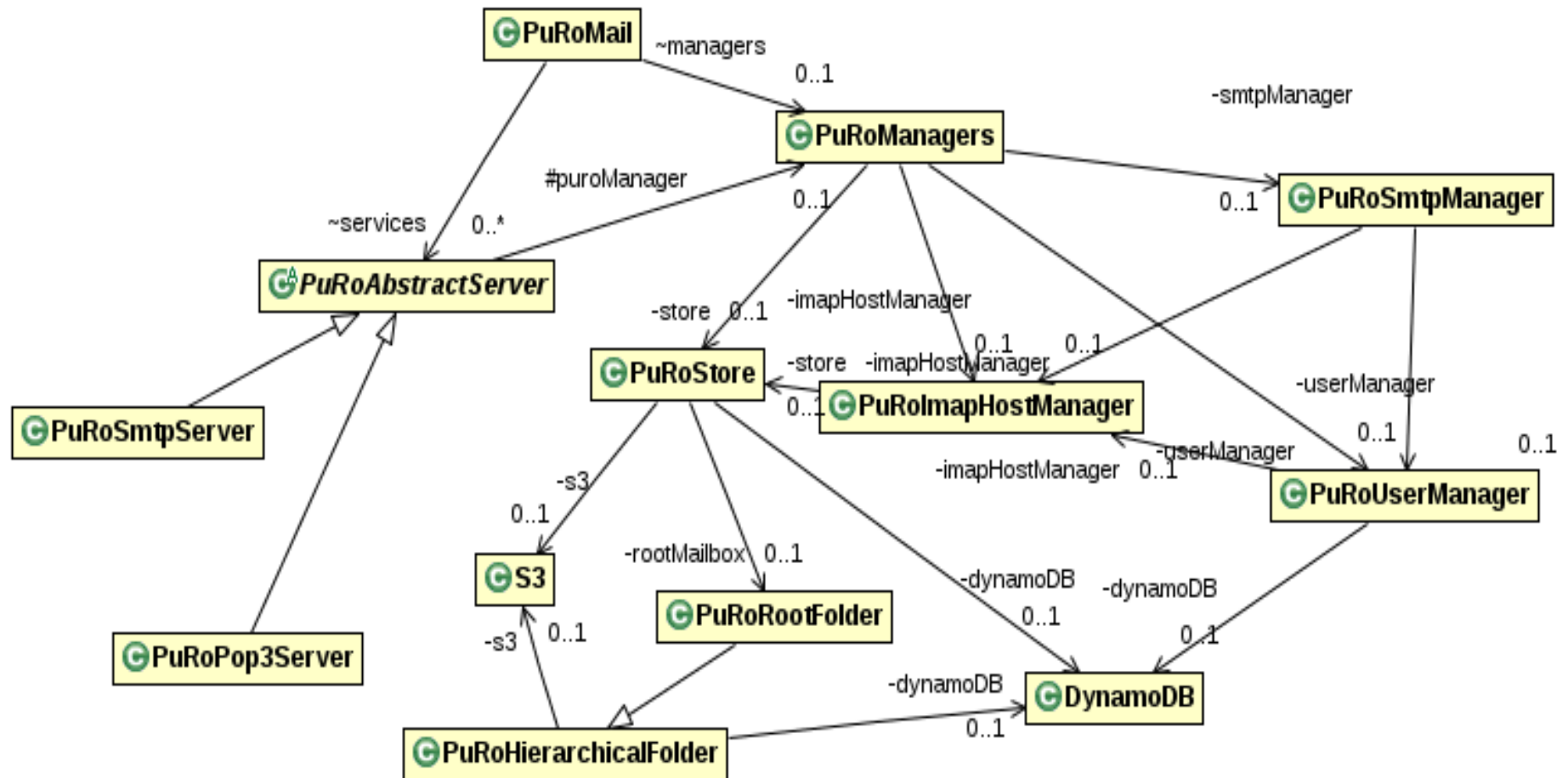


# Tier 2 - EC2



- Comandi **sincroni**
- Recupero parziale di metadati (uid - size)
- Un solo client verso DynamoDB e S3

# Class Diagram



# Tier 3 - DynamoDB (1/2)

- **NoSql (Not Only Sql) DBMS**
  - No schema fisso
- Tolleranza ai guasti mediante replicazione dei dati
- Altamente disponibile
- Capacità configurabile (Scalabile)
- **Read Eventually Consistent**
  - Adatto allo scopo
- Perchè non SimpleDB?
  - Dimensione massima 10 GB
  - Request Capacity Limit



# Tier 3 - DynamoDB (2/2)

User
<u>email</u>
password
firstname
lastname
folder
<i>lastupdate</i>
<i>region</i>

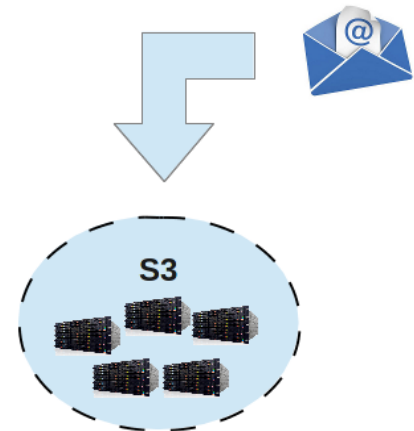
MetaMail
<u>folder</u>
<u>uid</u>
bucket
objectname
size
<i>header</i>
<i>timestamp</i>
<i>flags</i>
<i>lastupdate</i>

Folder
<u>name</u>
nextUID
parent
children
<i>selectable</i>
<i>lastupdate</i>

**PuRoConfig: readCapacityUnits, writeCapacityUnits, domain**

# Tier 4 - S3

- Altamente disponibile
  - 99.99 % Availability
- Tolleranza ai guasti
  - 99.999999999% Durability
- No Reduced Redundancy Storage (RRS)
- No Versioning
- Mail salvate per intero (header + body)
- Regione selezionata : Irlanda
  - Bassa latenza
  - Read After Writes per Put di nuovi elementi
  - Eventually Consistent per Put di overwrite e Delete





# Tolleranza ai guasti in DynamoDB e S3: (1/3)

```
220 ip-10-226-125-39/10.226.125.39 GreenMail SMTP Service
Ready
EHLO [192.168.1.3]
250-ip-10-226-125-39/10.226.125.39
250-AUTH=LOGIN
250-AUTH PLAIN
250 SIZE
MAIL FROM:<claudio@puro-mail.tk> SIZE=373
250 OK
RCPT TO:<damiano@puro-mail.tk>
250 OK
DATA
354 Start mail input; end with <CRLF>.<CRLF>
Message-ID: <51081621.1080302@puro-mail.tk>
Date: Tue, 29 Jan 2013 19:34:09 +0100
From: claudio <claudio@puro-mail.tk>
```

```
Message-ID: <51081621.1080302@puro-mail.tk>
Date: Tue, 29 Jan 2013 19:34:09 +0100
From: claudio <claudio@puro-mail.tk>
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:17.0)
Gecko/20130110 Thunderbird/17.0.2
MIME-Version: 1.0
To: damiano@puro-mail.tk
Subject: test
Content-Type: text/plain; charset=ISO-8859-15;
format=flowed
Content-Transfer-Encoding: 7bit


test
.
250 OK
QUIT
221 ip-10-226-125-39/10.226.125.39 Service closing
transmission channel
```

Services ▾ Edit ▾ pupparo.rossato @ 7381064... ▾ Global ▾ Help ▾

Upload Create Folder Actions ▾

None Properties Transfers ↻ ?

Buckets / puro-mail-eu-west

	Name	Storage Class	Size	Last Modified
<input type="checkbox"/>	 #mail.-977069894.INBOX_27505	Standard	545 bytes	Tue Jan 29 19:34:31 GMT+100 2013

# Tolleranza ai guasti in DynamoDB e S3: (2/3)



Comando RETR non riuscito. Errore nell'acquisizione del messaggio. Il server di posta puro-mail.tk ha risposto: it.prms.greenmail.store.FolderException: Server Error: PuRo unable to retrieve message

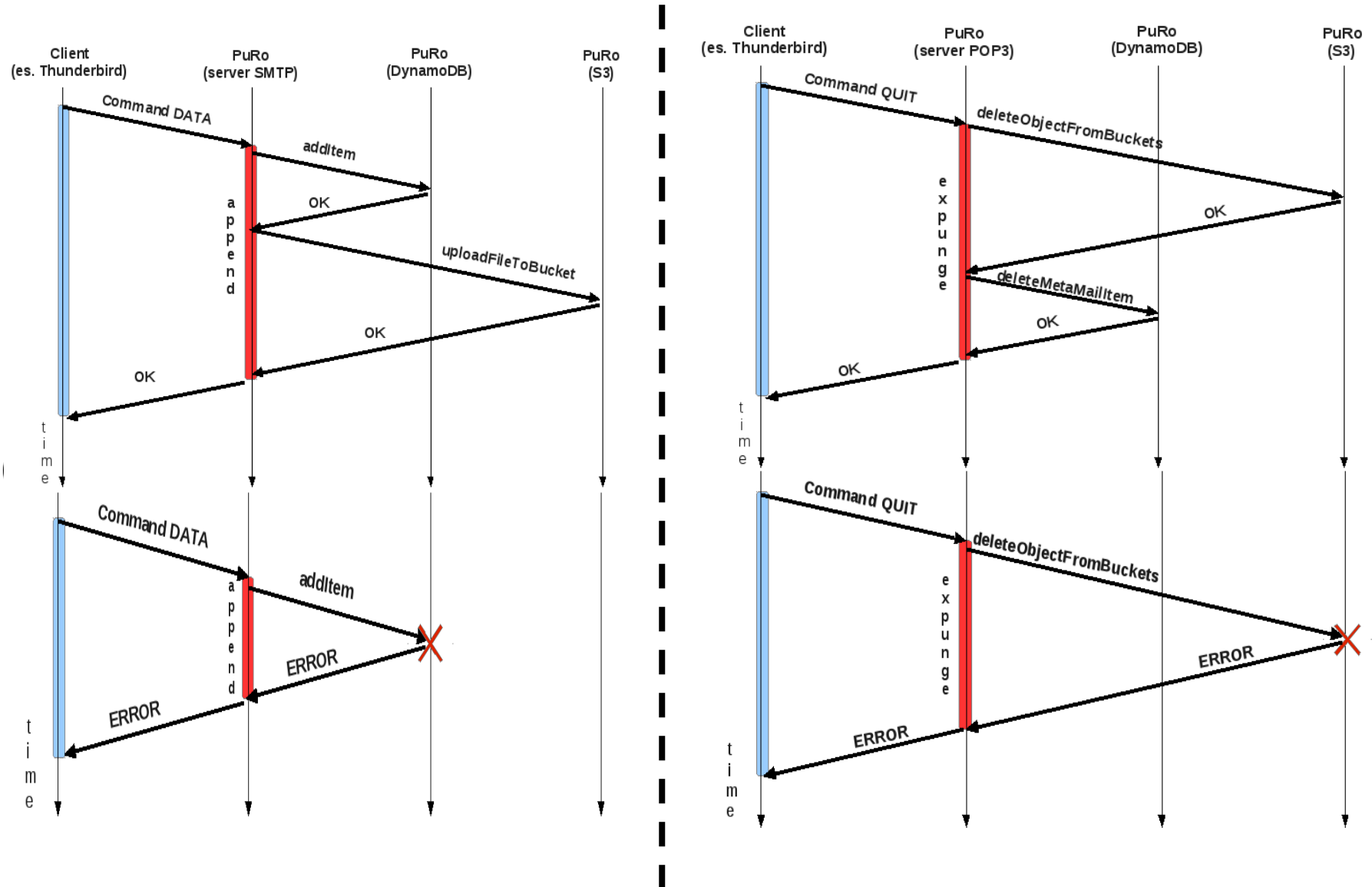
OK

```
+OK POP3 GreenMail Server ready
CAPA
-ERR Command not recognized
USER damiano
+OK
PASS *****
+OK
STAT
+OK 1 6
LIST
+OK
1 6
.
UIDL
+OK
1 27505
.
RETR 1
-ERR it.prms.greenmail.store.FolderException: Server
Error: PuRo unable to retrieve message
```

```
+OK POP3 GreenMail Server ready
CAPA
-ERR Command not recognized
USER damiano
+OK
PASS *****
+OK
STAT
+OK 0 0
QUIT
+OK bye see you soon
```



# Tolleranza ai guasti in DynamoDB e S3: (3/3)



# Test - CloudWatch

- EC2



**CPUUtilization**: percentuale di CPU utilizzata.



**NetworkIn**: Numero di byte ricevuti su tutte le interfacce di rete.



**NetworkOut**: Numero di byte inviati su tutte le interfacce di rete.

- Load Balancer



**Latency**: Tempo trascorso tra l'arrivo di una richiesta e la ricezione della relativa risposta al Load Balancer.

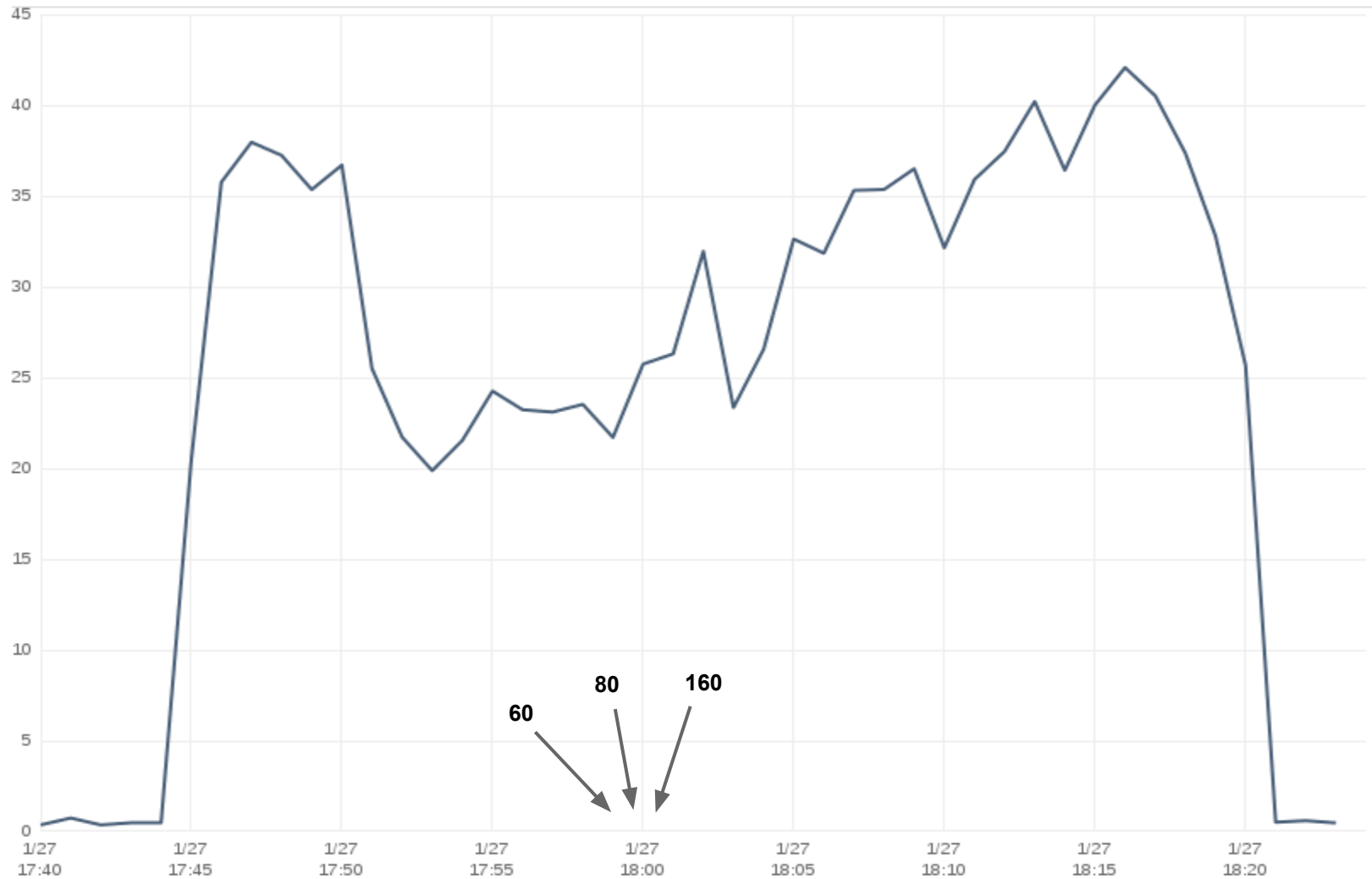
# Test - 3 availability zone

PuRoHighCPUAlarm [edit](#)

M1.Small

Average

1 Minute

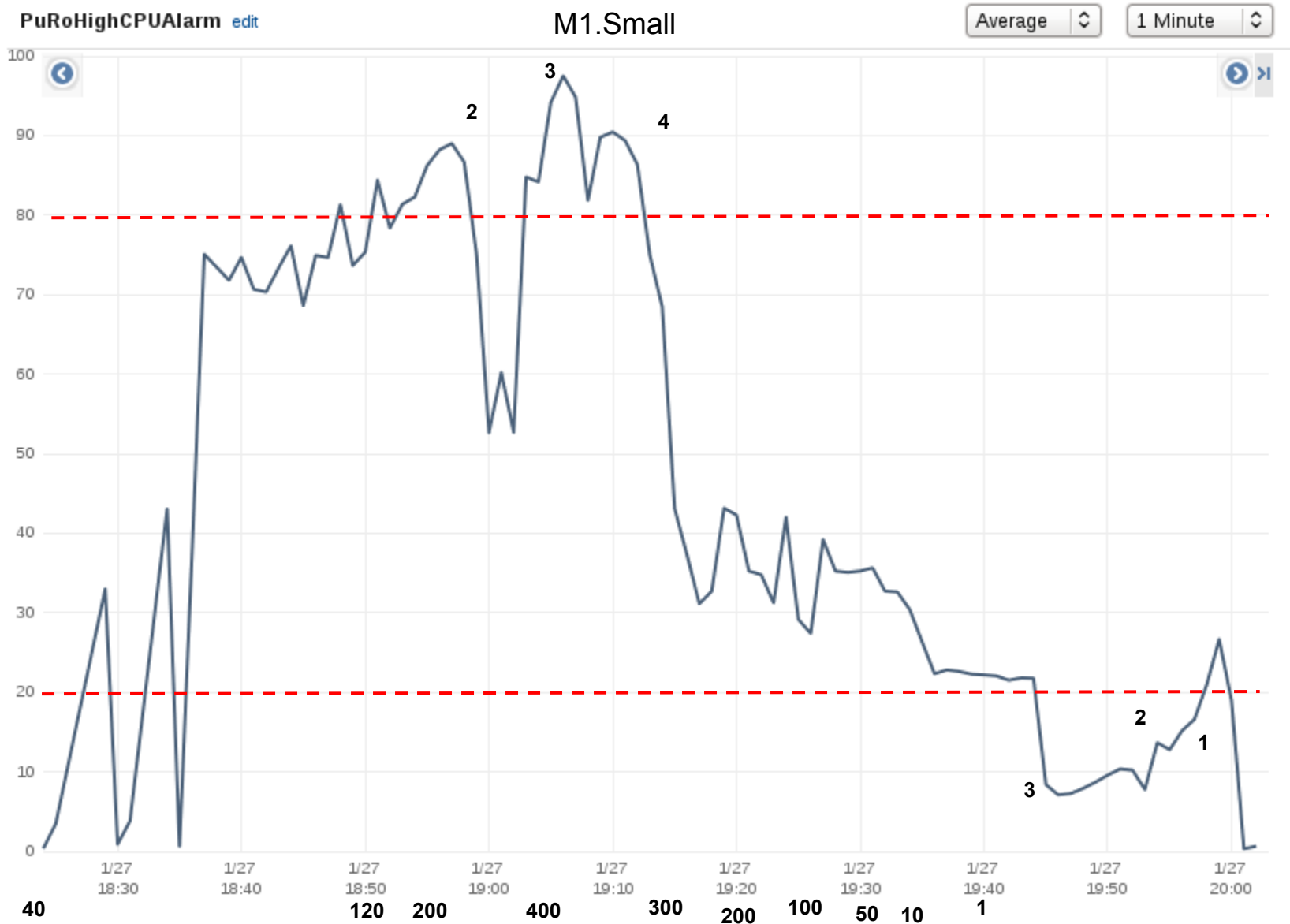


40

200

240

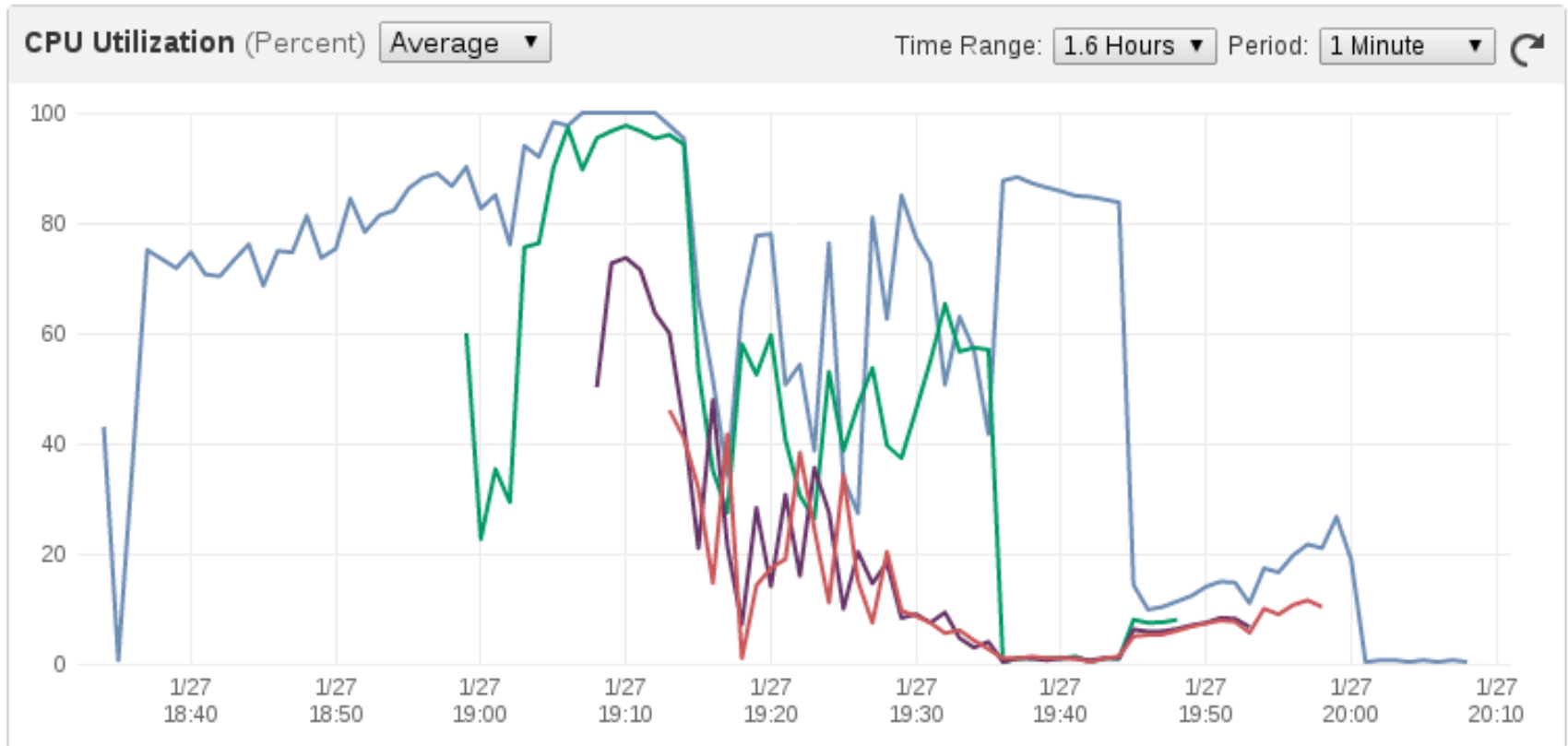
# Test - Autoscaling - 1 availability zone (1/4)



# Test - Autoscaling - 1 availability zone (2/4)

CloudWatch Monitoring Details

Cancel 



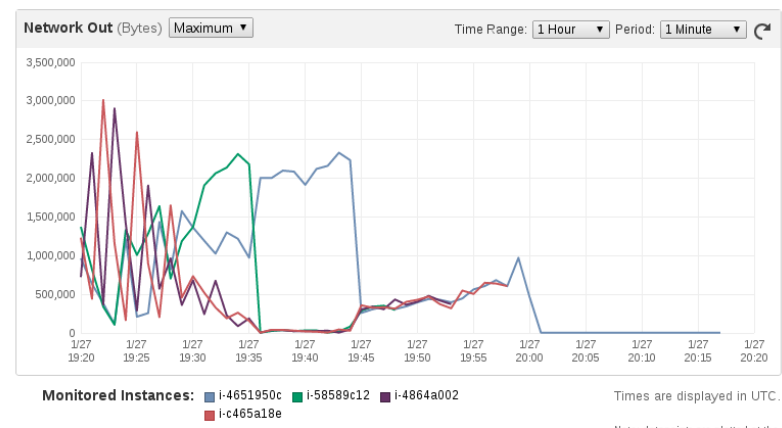
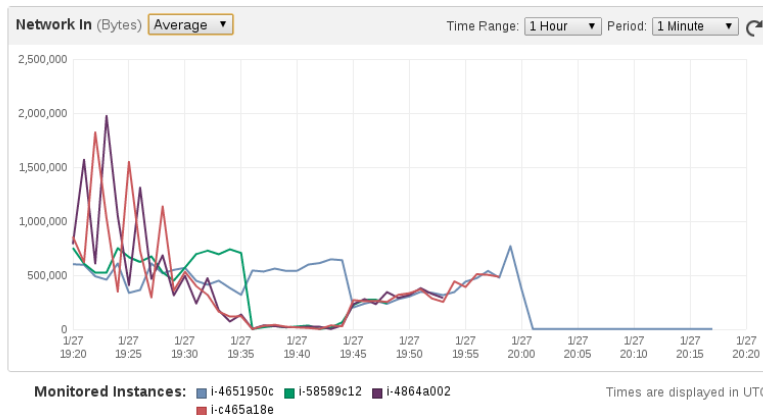
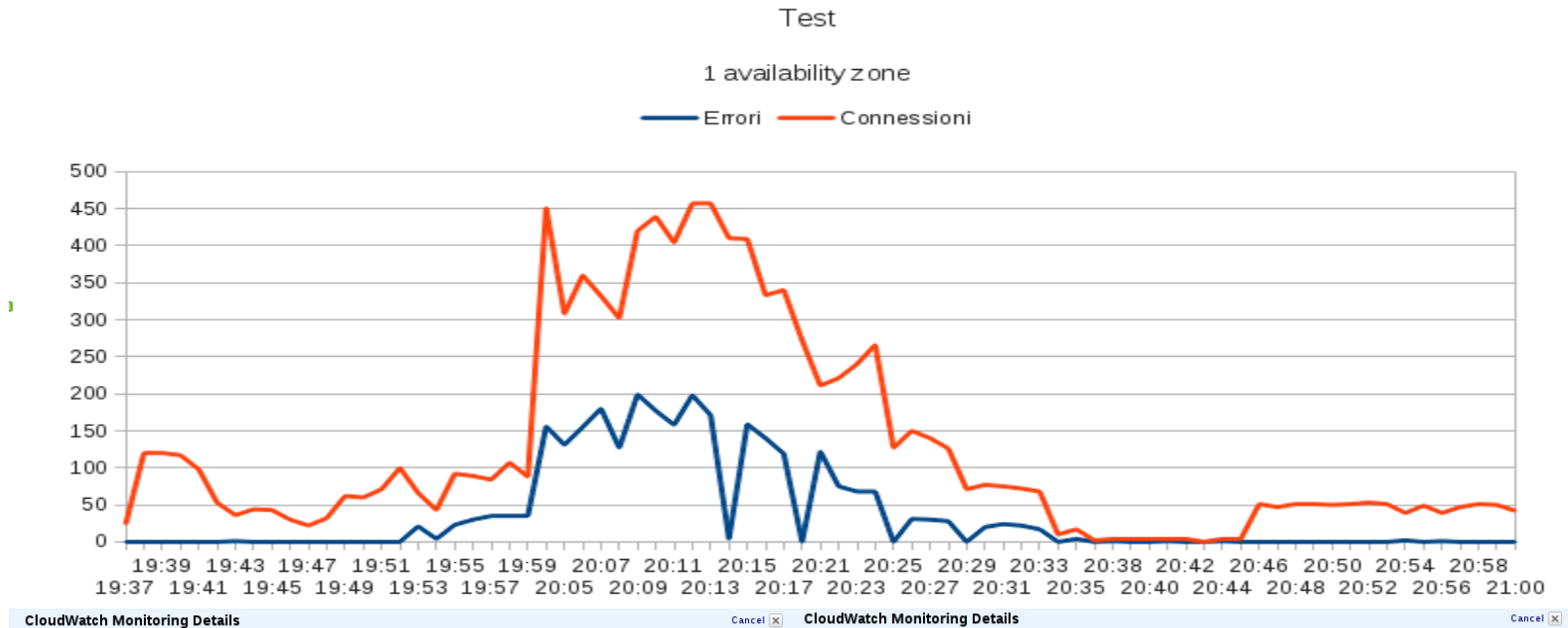
**Monitored Instances:** ■ i-4651950c ■ i-58589c12 ■ i-4864a002  
■ i-c465a18e

Times are displayed in UTC.

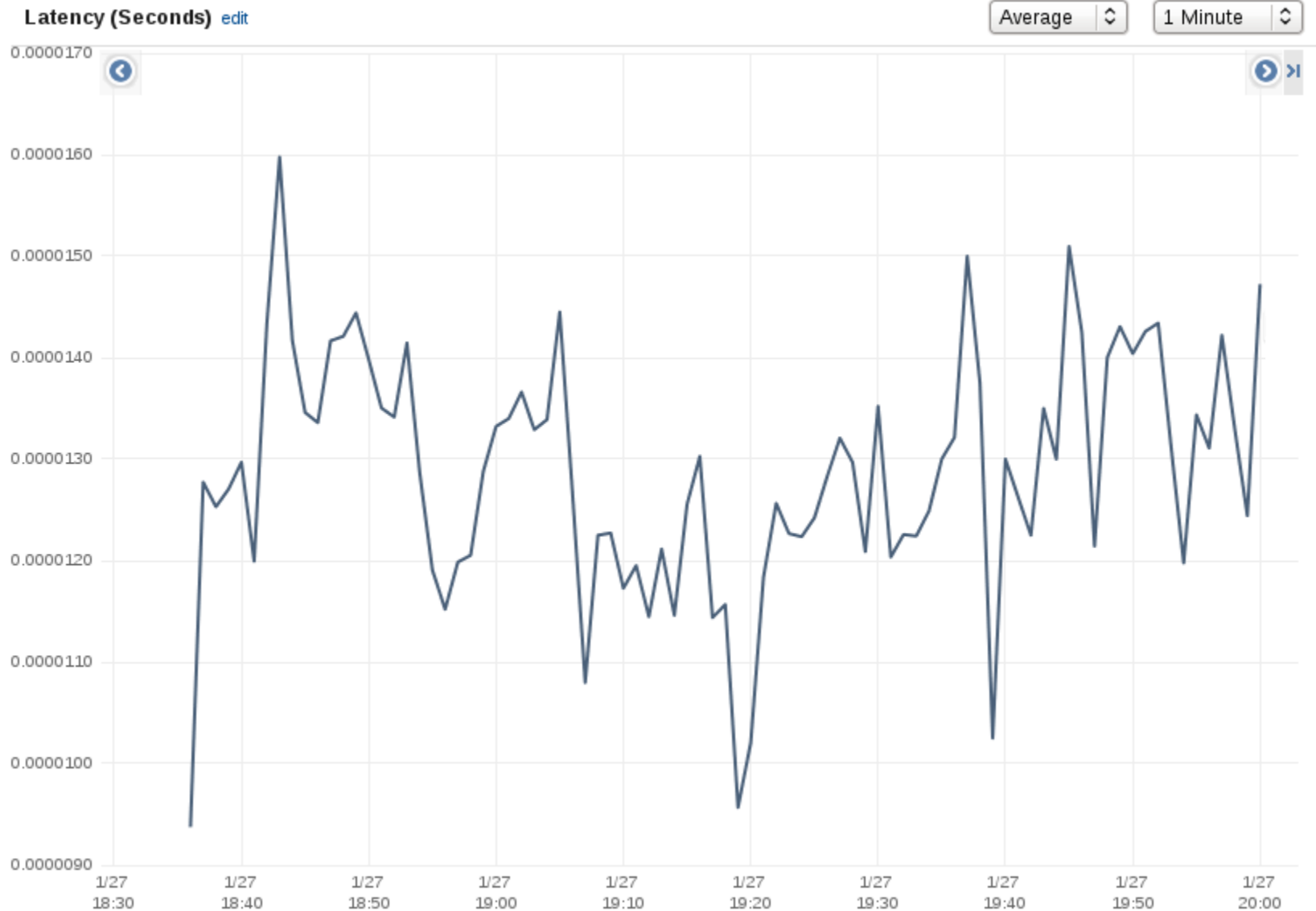
Note: datapoints are plotted at the start of the period.

Close

# Test - Autoscaling - 1 availability zone (3/4)



# Test - Autoscaling - 1 availability zone (4/4)



# Stima Costi

## Assunzioni:

- Utenti giornalieri: 100.000
- Numero mail inviate e ricevute: 10 / 10
- Dimensione media: 500KB



Servizio	Costo (\$/month)
Route 53	30.5
Elastic Load Balancing	258
Elastic Compute Cloud	144
DynamoDB	82,75
Simple Storage Service	332.85
CloudWatch	36,4
<b><u>Totale</u></b>	<b><u>884,5</u></b>



# Sviluppi futuri

- IMAP
  - Problematiche
    - Connessione simultanea di più utenti in parallelo con stesso account
    - Condivisione cartella fra più account
  - Soluzioni
    - Campo lastupdate
- Utenti multiregione
  - Vantaggi
    - Scalabilità geografica
  - Problematiche
    - Consistenza
  - Strumenti
    - Latency Based Routing Query
    - Metrica conteggio accessi

