CHAPTER – 5

POLICY MONITORING PERFORMANCE AUDIT TRAIL ASSESSMENT ALGORITHM-(PPAT)

5.1 Inception

The policies in cloud computing in particular to SaaS provisioning are maintained in the form of SLA's(service level agreements). SLA's are endorsed with service level objectives which are mutually agreed on predetermined service concerns between cloud provider and consumer. This SLA policy is maintained with set of principles, conditions, service level objectives which acts as a leaflet for both parties (consumer and provider). Broker play an authoritative role in SLA negotiations in monitoring of consumer preferences for the service provider service provisioning. The broker in this policy monitoring approach outcomes the bias information related to unfavoured judgements in decision making of service utilization. This scenario was modelled with an improved baseline by audit trail assessment approach. To our research problem in monitoring of policy auditor proves transparency in undertaking of provenance data. Many third party auditing consortiums like FEDRAMP, HIPAA, PCIDSS etc., are oriented for specific auditing domains which evaluates with standards and guidelines. Proposing of PPAT algorithm innovatively touches the policy monitoring approach by taking SLA parameters for audit trail assessment.

5.1.1 PPAT Design background

In construction of PPAT algorithm parameters of policy, data computations for integrity, co relation of data in provenance, service selections, quality requirements, provenance records, accountability and credibility of service workflows are considered. Integrity plays a main role for large data computations where the sensitivity issues of hardware such as boot time, bios configuration and OS kernel services are noticed. The verification of integrity in cloud platforms enables attestations as a property. Progger tool helps in provenance enabling the logging data activities which show cases fake entities, data actions and time stamp synchronizations.

Event correlate based on pearl is an open source light weight module which is enclosed with rule based approach for matching of co relation events [70]

Auditing ensures authentication and authorization as the two basic pillars for enhancing the attributes of availability, security, integrity and confidentiality. The data forensic mechanisms correlate the provenance data events that help for the proactive forensic techniques in resource monitoring and provenance tracking. [71]

The quality of service for the web based ontology was determined by the service selections, SLA's and monitors. Examining of SLA with quality of service was compared with existing approaches. A seven step process which outcomes the scope of the domain reuse of existing methods, method properties, class hierarchies, class differentiations, prioritizing the properties of class and instance. The above seven step process attributes deploys quality of service, determines the functional characteristics and metrics to the benchmark values. [72]

A referencing monitoring with security admin evaluates the authorization of database in the usage of provenance. Provenance based records encompasses with entity roles, event operations, preferences and message states. The profile role of a consumer showcases his behaviour towards policy evaluation instance. The concept of aggregation is carried on the above said provenance based records to show the policy variations. [73]

The concept of SLA evaluates the processing of services and their evaluations between consumer and provider. There may be disturbances in processing of services such as feedback, security, credibility are concerned. Reputation is a mutual highlighted task for both parties (cloud consumer and cloud provider) which relied on SLA life cycle phases. The feedback mechanisms for SLA policy accountability determine authentication credible statistics of the used provenance data about processing of services. [74]

5.2 Design assumptions of (PPAT)-Algorithm

The function of audit trails policy assessment for PPAT algorithm recommends the sequential process. From the PPAT design background analysis we confidently acquire the policy data between consumer and provider with their mutual concern. As the policies are handover to auditor for compliance monitoring the auditor with his operational computational activities will review the policy. Auditor basing on policy attributes embeds the mathematical approaches which targets the sensitivity factors of consumer, provider's potentiality for policy attainments leads in calculation of policy assessment score of the particular service provider.

5.2.1 Allotment phase

In this allotment phase consumer preferences for the quality of service attributes which regulates in the SLA policy are considered. The values of consumer preferences regarding policy attributes are distinguished as it is in chapter 4. Here the consumer is likely to be preferred two attributes strongly from the policy which may be availability and response time. To compute this PPAT algorithm table 3.4.2 was taken to examine the policy levels as lower bound and upper bound. The distinguished policy attributes for consumer preferences are computed with specific mathematical formulas. In the approach of PPAT algorithm consumer may have more interest on specific attributes that a provider provision. This consumer's urge is notified as sensitivity factor which stands as a base line for PPAT algorithm approach.

5.2.2 Assimilation phase

As the performance audit address three issues economy, effectiveness and efficiency the construction of PPAT algorithm exposes effectiveness issues transparently. The auditor assessment task for this PPAT algorithm take a responsibility of gathering average value for a particular attribute which may reflects in comparison of particular attribute that was predetermined in SLA document. Consumer urge towards services of the service provider is taken as sensitivity factor in considering auditor assessment for PPAT approach. The sensitivity values of a particular attribute given by a consumer were computed with SLA predefined values [64]. Finally auditor

assessment value for utility driven attributes and cost driven attributes are computed separately.

5.3 Formulating the Algorithm

In the scenario of PPAT construction the above discussed details from allotment and assimilation phase are taken into consideration. PPAT flowchart was depicted and PPAT algorithm process was clearly scripted with step by step order. Finally PPAT working illustration was carried for the given list of service providers.

5.3.1 Flowchart for the Algorithm-(PPAT)

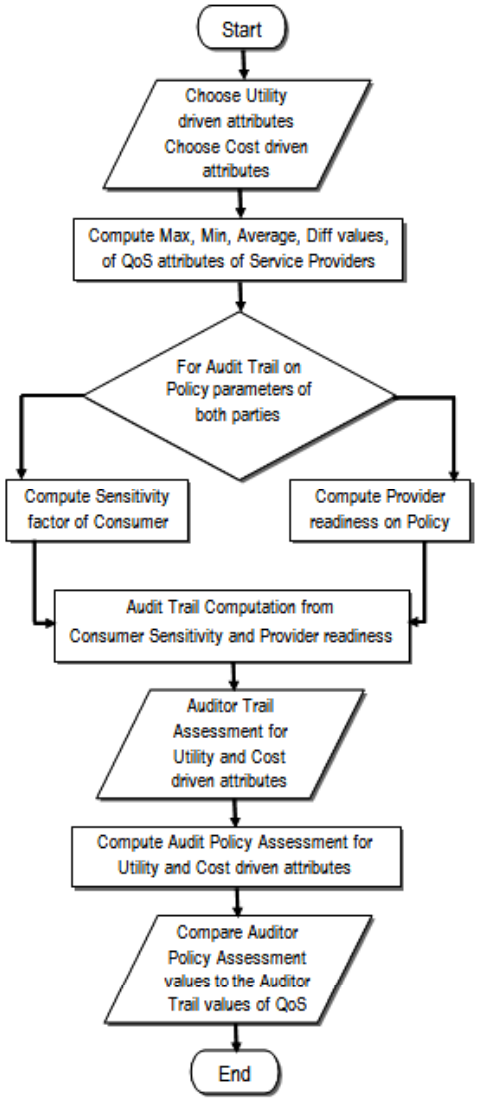


Fig 5.3.1 Flowchart for PPAT Algorithm

5.3.2 Algorithm-(PPAT) process

Step1: Let Quality of Service attributes defined as Q= $\{q_1, q_2 \ldots q_n\}$

ie., q_1 be the Quality of Service attribute... may be
[Availability, Reliability, Response time and Cost]
Where Q is normalized for the consistency of computations,
So that, the values lie between [0 and 1]

Step2: Let Potential Service Provider list with their service offerings is denoted as

SP= {SP1, SP2 ....SPk}
Where SP1= $Q\{q_1,q_2,\ldots q_n\}$
Where SP2= $Q\{q_1,q_2,\ldots q_n\}$
....
....
Where SPk= $Q\{q_1,q_2,\ldots q_n\}$
ie., q_1 be the Quality of Service attribute... may be
[Availability, Reliability, Response time and Cost]

Step3: Let Quality of Service attributes are classified as Utility driven attributes (UD) and Cost driven attributes (CD)

ie., Condition : Utility driven attributes (UD) should maximized
and Cost driven attributes (CD) should minimized

Step4: Optimistic assumption on SLA Policy parameter that consumer expect on Quality of Service attribute it may be Utility driven attributes (UD) and Cost driven attributes (CD) = (q'_n)

[Example: q'_1 may be for Availability 0.99 for Utility driven attributes (UD)]

[Example: q'_2 may be for Response Time 0.2 for Cost driven attributes (CD)]

Step5: Find the Max value for each Quality of Service attribute of SP

ie., Let MaxQ={$Maxq_1$,$Maxq_2$....$Maxq_n$}

Step6: Find the Min value for each Quality of Service attribute of SP

ie., Let MinQ={$Minq_1$,$Minq_2$....$Minq_n$}

Step7: Compute the Difference value using Step4 & Step5 of Quality of Service attribute

ie., Let Dv={($Maxq_1$- $Minq_1$), ($Maxq_2$- $Minq_2$),..... ($Maxq_n$- $Minq_n$),

Step8: Consumer Urge represented as Sensitivity factor on Optimistic assumption on SLA Policy parameter, where Sensitivity factor values may be integer [1 or 2 or 4] [where 1 represents Moderate, 2 represents Best, and 4 represents Good]

^{S} represents Sensitivity factor

CU=(q_n) ^{S}

Step9: Provider readiness for provision of service on SLA Policy parameter

Pr=(q'_n) * CU

Step10: Auditor Trail on Provider provision and Consumer Urge for that Policy parameter

AT=Pr / Average of (q_n)

Step11: Auditor Policy Assessment about that opted SLA Policy parameter for Utility driven attributes

APA= Average of (q_n) - Dv

Step12: Auditor Policy Assessment about that opted SLA Policy parameter Cost driven attributes

APA= Average of (q_n) * Dv

Step12: Compare the Auditor assessment value for Policy effectiveness of Utility driven and Cost driven attributes which are nearer.

5.3.2 Working Illustration of (PPAT) Algorithm

The demonstration of this PPAT algorithm confidently presents the mathematical representation baselines for the proposed procedures. We undertake the below four service providers Table 5.3.2.1 for illustration from the Table 3.4.2 from Chapter 3

SaaS_ID	Availability	Reliability	Cost($)	Response Time(ms)
SP3	0.99935	0.99962	0.168	0.3
SP10	0.99958	0.99956	0.484	0.3
SP17	0.99952	0.99967	0.638	0.5
SP24	0.99999	0.99992	0.508	0.5

Table 5.3.2.1 Dataset for illustration of PPAT Algorithm

For SaaS_ID SP3

Utility driven attributes from Table 5.3.2.1 are Availability and Reliability

Optimistic assumption on SLA Policy parameter that Consumer expects Availability as 0.99

Consumer Urge – Sensitivity factor about the Optimistic assumption on SLA Policy parameter [Availability]=2

$CU=(q_n)^S$

$CU= (0.99935)^2 = 0.998700423$

Provider readiness for provision of services on SLA Policy parameter

$Pr=(q'_n) * CU$

$Pr=(0.99) * 0.998700423$

$Pr=0.988713418$

Auditor Trail on Provider provision and Consumer Urge for that Policy parameter

$AT=Pr$ / Average of (q_n)

$AT=0.988713418 / 0.999577083$

$AT=0.989131739$

Auditor Policy Assessment about that opted SLA Policy parameter Utility driven attributes

APA= Average of (q_n) – Dv

$APA=0.999577083 - 0.00088$

$APA=0.998697083$

For SaaS_ID SP3

Cost driven attributes from Table 5.3.2.1 are Response Time

Optimistic assumption on SLA Policy parameter that Consumer expects Availability as 0.2

Consumer Urge – Sensitivity factor about the Optimistic assumption on SLA Policy parameter [Availability]=2

$CU=(q_n)^S$

$CU= (0.3)^2 = 0.09$

Provider readiness for provision of services on SLA Policy parameter

$Pr=(q'_n) * CU$

$Pr=(0.2) * 0.09$

$Pr=0.018$

Auditor Trail on Provider provision and Consumer Urge for that Policy parameter

AT=Pr / Average of (q_n)

AT=0.018 / 0.433333333

AT=0.041538462

Auditor Policy Assessment about that opted SLA Policy parameter Cost driven attributes

APA= Average of (q_n) * Dv

APA=0.433333333 * 0.5

APA=0.216666667

QoS Attributes	Max Value	Min Value	Difference Values
Availability	0.99999	0.99911	0.00088
Reliability	0.99992	0.9995	0.00042
Cost($)	0.804	0.134	0.67
Response Time(ms)	0.7	0.2	0.5

Table 5.3.2.2 Reckoned computations for Max, Min and Difference Values

SaaS_ID	**Utility driven Atttribute Availability**	**Computed Sensitivity factor on Availability**
SP3	0.99935	0.998700423
SP10	0.99958	0.999160176
SP17	0.99952	0.99904023
SP24	0.99999	0.99998

Table 5.3.2.3 Reckoned computations of Consumer Urge on Service Providers Provisions for Availability

SaaS_ID	Utility driven Atttribute Availability	Providers Readiness for Policy parameter
SP3	0.99935	0.988713418
SP10	0.99958	0.989168575
SP17	0.99952	0.989049828
SP24	0.99999	0.9899802

Table 5.3.2.4 Reckoned computations of Providers Readiness for Policy parameter Availability

SaaS_ID	Utility driven Atttribute Availability	Audit Trail on Consumer and Provider
SP3	0.99935	0.989131739
SP10	0.99958	0.989587088
SP17	0.99952	0.989468291
SP24	0.99999	0.990399056

Table 5.3.2.5 Reckoned computations of Audit Trail on Consumer and Provider for Availability

Optimistic assumption on SLA Policy parameter that consumer expect for Utility driven attribute Availability of 0.99	
Max Value of Utility driven attribute Availability	0.99999
Min Value of Utility driven attribute Availability	0.99911
Diff Value	0.00088
Average value of Utility driven attribute Availability	0.999577083
Auditor Policy Assessment about that opted SLA Policy parameter for Utility driven attribute Availability	0.998697083

Table 5.3.2.6 Reckoned computations of PPAT Algorithm Auditor Policy Assessment for Utility driven attribute

SaaS_ID	Cost driven Attribute Response Time(ms)	Computed Sensitivity factor on Response Time(ms)
SP3	0.3	0.09
SP10	0.3	0.09
SP17	0.5	0.25
SP24	0.5	0.25

Table 5.3.2.7 Reckoned computations of Consumer Urge on Service Providers Provisions for Response Time

SaaS_ID	Cost driven Attribute Response Time(ms)	Providers Readiness for Policy parameter
SP3	0.3	0.018
SP10	0.3	0.018
SP17	0.5	0.05
SP24	0.5	0.05

Table 5.3.2.8 Reckoned computations of Providers Readiness for Policy parameter Response Time(ms)

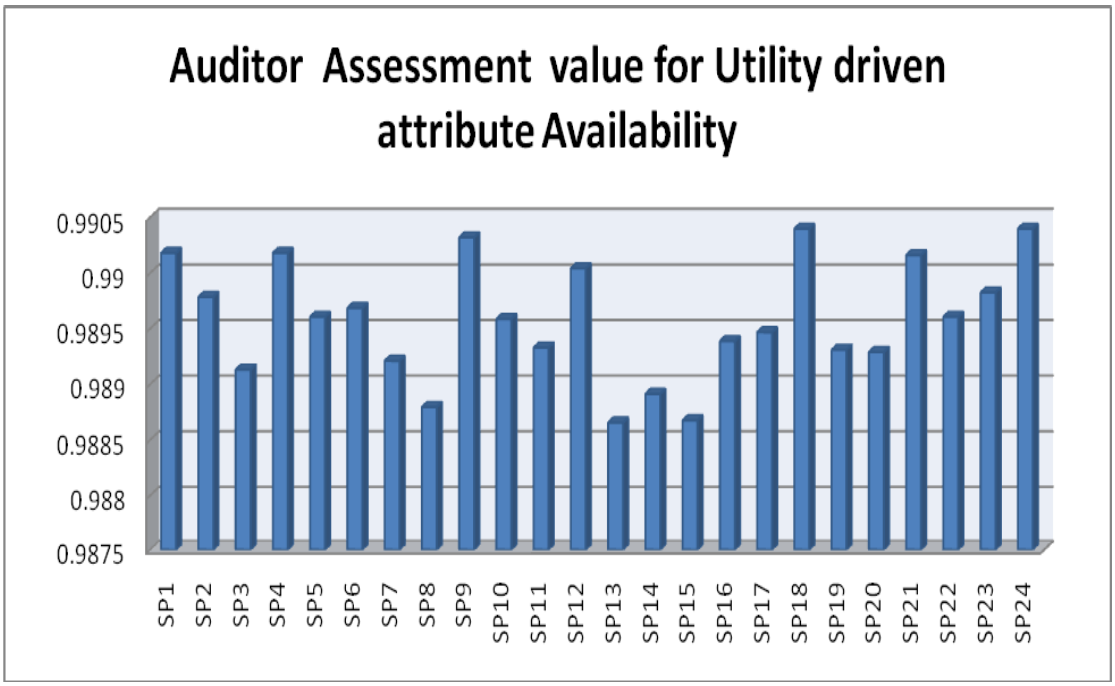
SaaS_ID	Cost driven Attribute Response Time(ms)	Audit Trail on Consumer and Provider
SP3	0.3	0.041538462
SP10	0.3	0.041538462
SP17	0.5	0.115384615
SP24	0.5	0.115384615

Table 5.3.2.9 Reckoned computations of Audit Trail on Consumer and Provider for Response Time

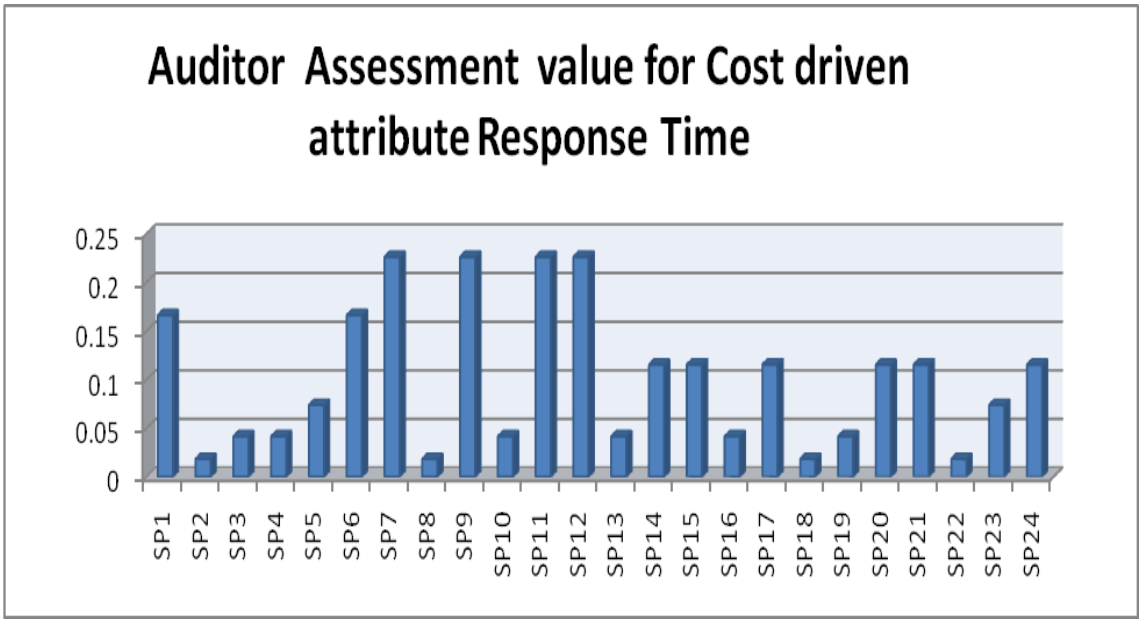
Optimistic assumption on SLA Policy parameter that consumer expect for Cost driven attribute Response Time(ms) of 0.2	
Max Value of Cost driven attribute Response Time(ms)	0.7
Min Value of Cost driven attribute Response Time(ms)	0.2
Diff Value	0.5
Average value of Cost driven attribute Response Time(ms)	0.433333333
Auditor Policy Assessment about that opted SLA Policy parameter for Cost driven attribute Response Time(ms)	0.216666667

Table 5.3.2.10 Reckoned for computations of PPAT Algorithm Auditor Policy Assessment for Cost driven attribute

The above Table 5.3.2.2 discloses the Quality of Service attributes with Max value, Min value and Difference Values which are used for calculations in PPAT Algorithm. The Reckoned Tables 5.3.2.3, 5.3.2.4, 5.3.2.5, and 5.3.2.6 consists of computation values of Utility driven attributes of PPAT Algorithm Auditor Policy Assessment. The Reckoned Tables 5.3.2.7, 5.3.2.8, 5.3.2.9, and 5.3.2.10 consists of computation values of Cost driven attributes of PPAT Algorithm Auditor Policy Assessment. The below Graph 5.3.2.1 showcase the Audit Trail on Utility driven attribute Availability and Graph 5.3.2.2 showcase the Audit Trail on Cost driven attribute Response Time which can resembled for comparisons towards the computed values in PPAT algorithm.



Graph 5.3.2.1 Audit Trail on Utility driven attribute Availability
X-axis: Service Providers Policy parameter Availability values
Y-axis: Policy parameter variations



Graph 5.3.2.2 Audit Trail on Cost driven attribute Availability
X-axis: Service Providers Policy parameter Response Time values
Y-axis: Policy parameter variations

5.4 Chapter Summary

In the promotion of PPAT algorithm the inception part acknowledges the importance of policies, SLA's in cloud environment. Auditor encounters some importance research contributions regarding parameters for integrity, SLA's for quality of service, profile and policy evaluation depending on consumer and SLA accountability. The design of this PPAT algorithm is synchronized in categorization and aggregation of required attributes which was discussed clearly in allotment and assimilation phases. Finally the policy effectiveness was illustrated well with examples.