Transaction cost analysis

An Approach to Capacity Planning

Capacity Planning

Capacity planning is the process of planning for growth and forecasting peak usage periods in order to meet system and application capacity requirements.

Transaction Cost Analysis

1. Compile a User profile
2. Execute discrete tests
3. Measure the cost of each operation
4. Calculate the cost of an average user profile
5. Calculate site capacity
6. Verify site capacity

Compile a user profile

1. Identify the number of user requests for each page and the respective percentages.

ID	URI	Number of requests	Percentages
1	/MyApp/login.aspx	18,234	35%
2	/MyApp/home.aspx	10,756	20%
3	/MyApp/logout.aspx	9,993	19%
4	/MyApp/SellStock.aspx	4,200	8%
5	/MyApp/BuyStock.aspx	9,423	18%
Total	n/a	52,606	100%

Compile a user profile

2. Identify the logical operations and number of requests required to complete the operation.

No. operations = No. requests / No. requests per operation

ID	URI	Number of requests	Requests per operation	Number of operations
1	/MyApp/login.aspx	18,234	2	9,117
2	/MyApp/logout.aspx	9,993	1	9,993
3	/MyApp/SellStock.aspx	4,200	2	2,100
4	/MyApp/BuyStock.aspx	9,423	3	3,141
Total	n/a	41,850	8	24,351

Compile a user profile

3. Identify the average user profile, session length, and operations per session.

Operation	Number of operations executed during an average session
Login	1
SellStock	3
BuyStock	2
Logout	1

Transaction Cost Analysis

1. Compile a User profile
2. **Execute discrete tests**
3. Measure the cost of each operation
4. Calculate the cost of an average user profile
5. Calculate site capacity
6. Verify site capacity

Execute Discrete Tests

Run discrete tests for each user operation identified in Step 1 for a load at which your system reaches maximum throughput.

User operation	Process\% Processor Time	ASP.NET Applications\Requests/Sec
Login	90%	441
SellStock	78%	241
BuyStock	83%	329
Logout	87%	510

Transaction Cost Analysis

1. Compile a User profile
2. Execute discrete tests
3. **Measure the cost of each operation**
4. Calculate the cost of an average user profile
5. Calculate site capacity
6. Verify site capacity

Measure Cost of Each Operation

Cost (Mcycles/request) = ((count(cpu) *x* cpu speed) *x* cpu use) / number of requests per second

((2 *x* 1,300 Mcycles/sec) *x* 0.90) / (441 Requests/Sec) = 5.30 Mcycles/request

Cost per operation = (number of Mcycles/request) **x** number of pages for an operation

5.30 x 3 = 15.9 Mcycles

Measure Cost of Each Operation

Measure the cost of each operation in terms of the limiting resource identified in Step 2.

User Operation	CPU % Utilization	Total net CPU Mcycles	ASP.NET Requests /Sec	Number of Requests	Operation Cost (Mcycles)	# Pages without login	Single operation cost
Login	90%	2,340.00	441	3	15.92	3	15.92
SellStock	78%	2,028.00	241	5	42.07	2	26.16
BuyStock	83%	2,158.00	329	6	39.36	3	23.44
Logout	87%	2,262.00	510	5	22.18	2	6.26

Transaction Cost Analysis

1. Compile a User profile
2. Execute discrete tests
3. Measure the cost of each operation
4. **Calculate the cost of an average user profile**
5. Calculate site capacity
6. Verify site capacity

Calculate the Cost of an Average User Profile

To estimate capacity, you need to assume an average user and then calculate the cost in terms of the limiting resource identified in Step 2.

Average User Profile	Number of operations executed during an average session	Cost per operation (Mcycles)	Total cost
Login	1	15.92	15.92
SellStock	3	26.16	78.47
BuyStock	2	23.44	46.87
Logout	1	6.26	6.26
Total			147.52

Transaction Cost Analysis

1. Compile a User profile
2. Execute discrete tests
3. Measure the cost of each operation
4. Calculate the cost of an average user profile
5. **Calculate site capacity**
6. Verify site capacity

Calculate Site Capacity

Calculating site capacity involves knowing how many users your application can support on specific hardware and what your site's future resource requirements are.

Maximum number of simultaneous users with a given profile =
(number of CPUs) *x* (CPU speed in Mcycles/sec) *x* (maximum CPU utilization) / (cost of user profile in Mcycles/sec)

(2 x 1300 x 0.75)/0.245 = 7,959 users

Calculate Site Capacity

If you want to plan for 10,000 users for the sample application and have a threshold limit of 75 percent defined for the processor, the number of CPUs required is:

Number of CPUs = (Number of users) *x* (Total cost of user profile in Mcycles/sec) / (CPU speed in MHz) *x* (Maximum CPU utilization)

10000 *x* 0.245 / (1.3 *x* 1000) *x* 0.75 = 2.51 processors

Transaction Cost Analysis

1. Compile a User profile
2. Execute discrete tests
3. Measure the cost of each operation
4. Calculate the cost of an average user profile
5. Calculate site capacity
6. **Verify site capacity**

Verify Site Capacity

Run the load tests to verify that the transaction cost analysis model accurately predicts your application capacity and future requirements.