1. .................................................................1

2. .................................................................4
  2.1 .................................................................4
  2.2 .................................................................6
     2.2.1 .................................................................6
     2.2.2 .................................................................8
  2.3 .................................................................9

3. .................................................................14
  3.1 End-To-End ....................................................14
     3.1.1 .................................................................15
     3.1.2 .................................................................16
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  3.3 .................................................................20
  3.4 .................................................................22
     3.4.1 .................................................................22
     3.4.2 .................................................................24
     3.4.3 HTTP ..........................................................25
     3.4.4 .................................................................27
     3.4.5 .................................................................28
1. おお

...
[1, 2, 3, 4], [3, 4], [5].
End-To-End, HTTP.
2. 简介

WWW(World Wide Web)

HTTP(HyperText Transfer Protocol)

HTML (HyperText Markup Language)

SGML(Standard Generalized Markup Language)
1. ネットワーク構成

インターネット（ISP）はWebクライアントに接続され、インターネットの利用を可能にします。インターネット（ISP）はインターネットサービスプロバイダ（ISP）[18]を提供し、Webサーバー、FTPサーバー、Eメールサーバー、データベース（Application Servers）に接続されます。External Third Party Content（External Third Party Content）は、アプリケーションサーバー、FTPサーバー、Eメールサーバー、データベース（Application Servers, FTP Server, E-mail Server, Database）を提供します。LAN（Local Area Network）は、インターネットの利用を可能にします。CGI（Common Gateway Interface）[27]は、FTP、Eメール、Database（データベース）を提供します。Webサーバーは、Webクライアントに接続され、インターネットの利用を可能にします。ISP（Internet Service Provider）[18]は、インターネットサービスプロバイダを提供し、Webクライアントに接続されます。
2.2  

2.2.1  

2.2.1.1  

[1, 7]  2  a)  2  [4, 23].  (Performance Metric)  (Response Time),  (Throughput),  (Error Rate)  (Threshold).
2. Web Service through Internet

performance metrics perceived by users

performance metrics of components

LAN

FTP Server
E-mail Server
Application Servers
Databases

Web Site

Load Balancer

Web Clients

Web Service through Internet
2.2.2 Client Server Access to Server

Client server access to server like a client.

![Diagram showing client server access]

3. Agent

Agent observe access to server and report performance metrics.

![Diagram showing agent observing access]

[1, 8]
2.3 Response Time Threshold

(Response Time Threshold)
Response Time Summary by Monitor
Friday October 13, 2000 12:00AM to Friday October 20, 2000 10:46PM
All Monitors from All Locations

4. Remote Monitor

5. SecretShopper


5. a) Local vs. Remote Data Load Time
5. b) Component Load Time Breakdown
### 6. ActiveWatch

Data Table

<table>
<thead>
<tr>
<th>Transaction</th>
<th>Size (KB)</th>
<th>Breakdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>eBay_Browse_Buy_Theme</td>
<td>52.49</td>
<td><img src="image" alt="Breakdown Chart" /></td>
</tr>
<tr>
<td>eBay_Home</td>
<td>101.82</td>
<td><img src="image" alt="Breakdown Chart" /></td>
</tr>
<tr>
<td>eBay_Search</td>
<td>66.48</td>
<td><img src="image" alt="Breakdown Chart" /></td>
</tr>
</tbody>
</table>

Milliseconds

[6, 11, 12].

(Performance Metric)
3. End-To-End ³×Æ®¿öÅ© ¿¬°áÀÌ

3.1  End-To-End ³×Æ®¿öÅ© ¿¬°áÀÌ

³×Æ®¿öÅ© ¿¬°áÀÌ HTTP ÁçÀÛÁ§ÀÔÇØ, °ú ÇÇòé [6, 9, 12, 25].
7. End To End

HTTP End-To-End

3.1.1

Les Cottrell and John Halperin[12], [19, 20, 21]. Ping Packet
Loss Rate | Round Trip Time | (Congestion) | Traceping [21] | traceroute | ping | Packet Loss Rate | ping
---------|---------------|-------------|--------------|------------|-----|-----------------|-----

3.1.2  

CPU Usage | Memory Usage
---------|---------------

Unix [top, vmstat] | Windows registry

3.2  HTTP

3.1  End-To-End

HTTP (HTTP Transaction)
8. HTTP

HTTP 8 URL(Uniform Resource Locators)[30]. URL IP DNS IP TCP URL IP TCP [1, 10]. HTTP HTTP.
$RT(x) \quad x \quad \text{Response Time}$, $T(x, y) \quad x \quad y \quad \text{HTTP Transaction}$, $D_i (1 \leq i \leq n) \quad H \quad n \quad i$

$RT (H) \; ? \; T (H, DNS Resolution) \; ? \; T (H, TCP Connection)$

$\begin{align*}
? & \quad n \quad RT (D_i) \\
1 &
\end{align*}$

$RT (D_i) \; ? \; T (D_i, Server Response) \; ? \; T (D_i, Data Transfer)$

$\begin{align*}
? & \quad n \quad T (D_i, Decode) \\
1 &
\end{align*}$

$\begin{align*}
(3.1) & \quad (3.2) & \quad (3.3)
\end{align*}$

$RT (H) \; ? \; T (H, DNS Resolution) \; ? \; T (H, TCP Connection)$

$\begin{align*}
? & \quad n \quad T (D_i, Server Response) \quad ? \quad n \quad T (D_i, Data Transfer) \\
1 & \quad 1
\end{align*}$

$\begin{align*}
? & \quad n \quad T (D_i, Decode) \\
1 &
\end{align*}$

$\begin{align*}
(3.3)
\end{align*}$

$DNS Resolution Time \; ? \; TCP Connection Time$

$? \; Server Response Time \; ? \; Data Transfer Time$

$? \; Decode Time$

HTTP $\quad \text{Response header}$

TCP $\quad \text{Connection Time}$

Server Response $\quad \text{HTTP GET}$

HTTP $\quad \text{Response header}$

Data Transfer $\quad \text{HTTP Response header}$

HTTP $\quad \text{Response}$

Decode $\quad \text{HTTP Response}$
End-To-End

Transfer

Decode

Local Data, Non-Local Data

TCP Connect
dns resolution

RT (H) = T(H, DNS Resolution) + T(H, TCP Connection)

LocalData Response Time = NonLocalData Response Time

HTTP

DNS Resolution Time = TCP Connection

Text Data, Image Data, Applet Data, Other Embedded Data

RT (H) = T(H, DNS Resolution) + T(H, TCP Connection)

TextData Response Time = ImageData Response Time

AppletData Response Time

OtherEmbeddedData Response Time
3.3 Diagram

9. Figure
$RT_i (x)$, $W_i$, $H_i$ (1 $\leq i \leq n$)

Response Time Threshold

$$RT(W) \leq H_1$$ (3.6)

$$RT(W) \leq H_2 \leq H_3, H_4, H_5 \leq \cdots \leq H_n$$ (3.7)
3.4 End-To-End

End-To-End

3.4.1 End-To-End

ICMP
Packet Loss Rate and Round-Trip Time, Packet Loss Rate Per Network Segment (\%)

3.4.1.1 Packet Loss Rate

\[
\text{PLR}(x) = \text{Packet Loss Rate}(\%) \quad \text{SN}(x, y) \quad \text{y}
\]

\[
\text{RN}(x, y) \quad \text{y}
\]

\[
\text{PLR}(W) = \frac{\text{SN}(W, \text{ICMP} \text{Echo}) - \text{RN}(W, \text{ICMP} \text{Echo Re}\;\text{ply})}{\text{SN}(W, \text{ICMP} \text{Echo})} \times 100
\] (3.8)

3.4.1.2 Round-Trip Time

\[
\text{RTT}(x) = \text{Round-Trip Time}(\text{sec}) \quad \text{ST}(x, y) \quad \text{y}
\]

\[
\text{RT}(x, y) \quad \text{y}
\]

\[
\text{RT}(W) = \text{RT}(W, \text{ICMP} \text{Echo Re}\;\text{ply}) - \text{ST}(W, \text{ICMP} \text{Echo})
\] (3.9)
RTT

3.4.1.3  Packet Loss Rate Per Network Segment

\[
\text{PLR}(NS_i) \quad \text{or} \quad \text{PLR}(R_i) \\
= \frac{\left[ SN(R_i, ICMPEcho) \quad RN(R_i, ICMPEchoRe ply) \right]}{SN(R_i, ICMPEcho)} \times 100
\]

Packet Loss Per Network Segment(\%) \quad (3.10) \quad \text{Packet Loss Rate} \quad \text{.}

3.4.2  \text{CPU Usage, Memory Usage, Network Connectivity} \quad \text{. }

3.4.2.1  \text{Network Connectivity}
3.4.2.2 CPU Usage

CPU (%) º»ÇÑ¸¦. CPUºÎÁ·ÀÎÁö¸¦. CPU (%) º»ÇÑ¸¦.

3.4.2.3 Memory Usage

Memory (%) º»ÇÑ¸¦. MemoryºÎÁ·ÀÎÁö¸¦. Memory (%) º»ÇÑ¸¦.

3.4.3 HTTP Response Time, Througput, Error Rate

HTTP Response Time, Througput, Error Rate. HTTP Response Time, Througput, Error Rate.

3.4.3.1 Response Time

Response Time(sec) HTTP Response Time, DNS Resolution Time, TCP Connection Time, Response Time.

(3.3) Response Time, DNS Resolution Time, TCP Connection Time. (3.5) DNS Resolution Time.
HTTP Resolution Time, Data Transfer Time, Decode Time, End-To-End.

3.4.3.2 Throughput

\[ T \text{put}(x) = \frac{DV(x)}{RT(x)} \]  \hspace{1cm} (3.11)

H HTTP, 100%.(3.11) 

\[ T \text{put}(H) = \frac{DV(H)}{RT(H)} \]  \hspace{1cm} (3.12)

3.4.3.3 Error Rate

\[ ER(x) = \frac{EN(x)}{MN(x)} \times 100 \]  \hspace{1cm} (3.13)

H HTTP, 100%.(3.13) 

\[ ER(H) = \frac{EN(H)}{MN(H)} \times 100 \]  \hspace{1cm} (3.14)
3.4.4 Response Time, Throughput, Error Rate

3.4.4.1 Response Time

$\text{Response Time (sec)} = \frac{\text{Response Time}}{\text{Throughput}}$

$\text{(3.6)}$

3.4.4.2 Throughput

$\text{Throughput} = \frac{DV(W)}{RT(W)}$

$\text{(3.11)}$

$T\text{put}(W) = \frac{DV(W)}{RT(W)}$
3.4.4.3 Error Rate

Error Rate(%): \( ER(W) = \left( \frac{EN(W)}{MN(W)} \right) \times 100 \) (3.16)

3.4.5 

10. 10. 10. 10. 10. 10. 10. 10. 10. 10.
<table>
<thead>
<tr>
<th></th>
<th>HTTP Response Time</th>
<th>Throughput, Error Rate</th>
<th>Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End-To-End ³×Æ®¿öÅ© ¼­ºñ½º ÅÛ ·¹º§±îÁö Á¶»çÇϰí, HTTP ·Î±×·¥À» ·¾Æ³½´Ù ±×¸®°í HTTP Æ®·£Á§¼ÇÀÇ DNS Resolution, TCP Connection, Server Response, Data Transfer, Decode ³×Æ®¿öÅ©. Data Transfer ³×Æ®¿öÅ© ¼¼±×¸ÕÆ®¸¦ ¼¼±×¸ÕÆ®¿¡¼­ È¥ÀâÀÌ »ý°Ü¼­ À¥¼­ºñ½º Àüü ½Ã°£ ÀÌ ´À·Á. ÆÄ¾ÇÇϰí, Packet Loss Rate ³×Æ®¿öÅ© §Í ³×Æ®¿öÅ© ¼¼±×¸ÕÆ®¿ ¡¼­ ¹®Á¦ÀÇ. ³×Æ®¿öÅ© ÀÇ ¼¼±×¸ÕÆ®¿¡¼­ ¹®Á¦°¡ µÇ´Â À¥¼­ºñ½º Æ®·£ Á§¼Ç ÀÇ ¼º´É À» ¹Ý¿µÇϰí, Response Time À» ¹Ý¿µÇÑ´Ù. 

- 29
4. 

3. 

4.1 

11. 

Web Service Performance Measurement System

Measurement Manager

Measurement Agent

Internet

Web Site

TCP Communication: Separate Measurement and Management

User Interface through Web

access to server like a client

Measurement Manager

Measurement Agent

Internet (ISPs)

Web Site

User Interface through Web

TCP Communication: Separate Measurement and Management

access to server like a client
4.2 Measurement Manager

Measurement Manager is a component responsible for managing and controlling the measurement process. It interacts with the Measurement Agent, Policy DB, Report DB, and Web Service Transaction Info. to manage the workflow of measuring and reporting performance data.

- Measurement Manager:
  - Manages measurement requests.
  - Handles response time threshold and error rate threshold.
  - Interacts with Policy DB and Report DB.
  - Requests measurement from Measurement Agent and Web Server.
  - Stores measurement results in Policy DB and Report DB.

Measurement Agent:
- Receives measurement requests from Measurement Manager.
- Measures Web Service Transaction Info.
- Reports measurement results to Measurement Manager.
- Handles URL Addresses, Parameters, and Used Application.

Web Service Transaction Info:
- Contains Service Name, Service Description, Sampling Interval, Response Time Threshold, Error Rate Threshold, URL Addresses, Parameters, and Used Application.

Diagram:
- User Interface sends Web Service Transaction Info. to Web Server.
- Web Server sends Web Service Transaction Info. to Measurement Controller.
- Measurement Controller sends Measurement Request to Measurement Agent.
- Measurement Agent measures Web Service Transaction Info.
- Measurement Agent sends Measurement Reply to Measurement Controller.
- Measurement Controller sends Measurement Request to Policy DB and Report DB.
- Policy DB and Report DB store measurement results.

Network Performance Info:
- Contains Network Performance Info.

Client System Performance Info:
- Contains Client System Performance Info.

HTTP Transaction Performance Info:
- Contains HTTP Transaction Performance Info.

Transaction Info.:
- Contains Transaction Info. for Web Service.

User Interface:
- User Interface is responsible for generating measurement requests.

Web Service:
- Web Service is responsible for processing measurement requests and sending Web Service Transaction Info.

Analyzer:
- Analyzer processes Web Service Transaction Info. and generates analyzed Web Service Performance Info.

Communicator:
- Communicator sends Measurement Request to Measurement Agent.

Measurement Agent:
- Measurement Agent is responsible for measuring Web Service Transaction Info. and sending Measurement Reply to Measurement Controller.

12. Measurement Manager

Measurement Manager is a critical component in the measurement process, ensuring that all necessary data is collected and reported accurately. It coordinates with other components to ensure the seamless flow of information.

Diagram:
- User Interface sends Measurement Request to Measurement Controller.
- Measurement Controller communicates with Policy DB and Report DB.
- Measurement Controller sends Measurement Request to Measurement Agent.
- Measurement Agent measures Web Service Transaction Info.
- Measurement Agent sends Measurement Reply to Measurement Controller.
- Measurement Controller sends Measurement Request to Web Server.
- Web Server processes measurement requests and sends Web Service Transaction Info.

Network Performance Info:
- Contains Network Performance Info.

Client System Performance Info:
- Contains Client System Performance Info.

HTTP Transaction Performance Info:
- Contains HTTP Transaction Performance Info.

Transaction Info.:
- Contains Transaction Info. for Web Service.

User Interface:
- User Interface is responsible for generating measurement requests.

Web Service:
- Web Service is responsible for processing measurement requests and sending Web Service Transaction Info.

Analyzer:
- Analyzer processes Web Service Transaction Info. and generates analyzed Web Service Performance Info.

Communicator:
- Communicator sends Measurement Request to Measurement Agent.

Measurement Agent:
- Measurement Agent is responsible for measuring Web Service Transaction Info. and sending Measurement Reply to Measurement Controller.

12. Measurement Manager

Measurement Manager is a critical component in the measurement process, ensuring that all necessary data is collected and reported accurately. It coordinates with other components to ensure the seamless flow of information.
4.2.1 User Interface


4.2.2 Analyzer

Report DB, Policy DB. Response Time Threshold, Error Rate Threshold, User Interface.
4.2.3 Policy DB  Report DB

Policy DB: Policy Database
Report DB: Report Database

---

13. (Relational Data Model)

Policy DB: a) Policy DB
Report DB: b) Report DB
4.2.4 Measurement Controller

Measurement Agent, Policy DB, Measurement Request, Measurement Agent, Measurement Reply, Report DB.

4.2.5 Communicator

Measurement Agent, TCP, Measurement Request, Measurement Reply, Measurement Request, Measurement Request, Message Reply, Message Reply.

4.3 Measurement Agent

Measurement Agent, 3.4.4, Measurement Agent, 14.4, Measurement Manager, Performance Information Collector, HTTP Client Simulator, Network Measurer, Client System Measurer.
14. Measurement Agent

4.3.1 Communicator

Measurement Manager \(\rightarrow\) TCP \(\rightarrow\) HTTP \(\rightarrow\) Performance Information Collector \(\rightarrow\) Network Measurer \(\rightarrow\) Client System Measurer \(\rightarrow\) Web Site

4.3.2 Performance Information Collector

Communicator \(\rightarrow\) Network Measurer \(\rightarrow\) 3.3 \(\rightarrow\) Client System Measurer
4.3.3 HTTP Client Simulator

HTTP Client Simulator

HTTP Client Simulator 3.2 HTTP HTTP Address, Parameter for HTTP Transaction
Response Time Throughput, Error State. Response Time HTTP 
HTTP Address, Parameter for HTTP Transaction
Response Time By Processing Sequence Response Time By Contents Type Response Time By Contents Location

HTTP Request Creator

HTTP Communicator

HTTP Request

HTTP Response

Web Site

HTTP Response Parser

HTTP Response Decoder

Performance Information Collector

HTTP Address, Parameter for HTTP Transaction
Response Time, Error, Utilization Response Time By Processing Sequence Response Time By Contents Type Response Time By Contents Location

Time Request

Generated time

URL Addresses and Parameters for An Embedded Object, Encoding Time

Encoded Time

HTTP Response Message

HTTP Response

Body of HTTP Response Message

Encoding Time

HTTP Request HTTP Response

15. HTTP Client Simulator

HTTP Client Simulator 15 HTTP
Communicator
HTTP Request Creator
HTTP Response Parser
HTTP Response Decoder

4.3.4 Network Measurer

3.4.1 Performance Information Collector
Ping
tracroute
Round Trip Time
Packet Loss Rate
trace route
Packet Loss Rate
Performance Information Collector

4.3.5 Client System Measurer

Network Connectivity, CPU Usage, Memory Usage
(Network Connectivity) Unix
top registry file
CPU Usage Memory Usage
5. 系统配置

4 个以太网口。支持 TCP/IP、IPX/SPX、NetBEUI 等多种网络协议，以及 Telnet、FTP、HTTP 等多种应用协议。系统支持各种网络设备，包括路由器、交换机等。

5.1 硬件

<table>
<thead>
<tr>
<th>硬件配置</th>
<th>详细信息</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Intel Pentium III, 450MHz</td>
</tr>
<tr>
<td>Memory</td>
<td>128MB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>软件配置</th>
<th>详细信息</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating System</td>
<td>Windows 2000</td>
</tr>
<tr>
<td>Language</td>
<td>C, PHP</td>
</tr>
<tr>
<td>Database</td>
<td>MS-Access 2000</td>
</tr>
<tr>
<td>Web Server</td>
<td>IIS 4.0</td>
</tr>
<tr>
<td>Graphic library</td>
<td>GD 1.6.2</td>
</tr>
</tbody>
</table>
5.2 The Registration Form for Web Service Transaction

a) The Registration Form for Web Service Transaction

b) The Registration Form for HTTP Transaction

c) The Input Form for Application

16. The Input Form for Application

3.3 Sampling Interval, Response Time Threshold, Error Rate Threshold, HTTP URL Address

URL
5.3 Web Service Transaction Report

<table>
<thead>
<tr>
<th>Service Name</th>
<th>Status</th>
<th>Response Time</th>
<th>Error Rate</th>
<th>Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership</td>
<td>bad</td>
<td>24 &gt; 17 sec</td>
<td>8 %</td>
<td>1000 byte/sec</td>
</tr>
</tbody>
</table>

Round-Trip Time: 325 msec
Packet Loss Rate: 30%
Packet Loss Rate Per Network Segment:

<table>
<thead>
<tr>
<th></th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
<th>R7</th>
<th>R8</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Network Connectivity: Good
CPU: 40%
Memory: 80%

Response Time: 16 sec

D: DNS resolution time, C: TCP connection time, S: Server response time, DT: Data transfer time, DD: Data Decode time

---

17. HTTP Transaction Performance

D: DNS resolution time, C: TCP connection time, S: Server response time, DT: Data transfer time, DD: Data Decode time
Data Transfer

Image

URL

Packet Loss

End-To-End
### 5.4 Web Service Transaction Report

<table>
<thead>
<tr>
<th>Service Name</th>
<th>Status</th>
<th>Response Time</th>
<th>Error Rate</th>
<th>Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership</td>
<td>bad</td>
<td>10 sec</td>
<td>28 &gt; 10%</td>
<td>1000 byte/sec</td>
</tr>
</tbody>
</table>

- **Error Rate**: 28%
- **Response Time**: 10 sec
- **Utilization**: 1000 byte/sec

**a) Overall Web Service Performance**

**b) Web Service Transaction Performance**

**c) HTTP Transaction Performance**

**d) Network Performance**

- **Round-Trip Time**: 35 msec
- **Packet Loss Rate**: 0%

**Packet Loss Rate Per Network Segment**:

<table>
<thead>
<tr>
<th>Segment</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
<th>R7</th>
<th>R8</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**e) Client System Performance**

- **CPU**: 40%
- **Memory**: 80%
- **Network Connectivity**: Good
- **Round-Trip Time**: 35 msec
- **Packet Loss Rate**: 0%
- **Packet Loss Rate Per Network Segment**: 0%

**Network Connectivity**: Good

**CPU**: 40%

**Memory**: 80%

**Round-Trip Time**: 35 msec

**Packet Loss Rate**: 0%

**Packet Loss Rate Per Network Segment**: 0%

**Error Rate**

18.

**18** a) Overall Web Service Performance

18. (Error Rate)
End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End ³×Æ®¿öÅ©, HTTP ³ë½Å , End-To-End


[27] Ian Graham, “An Introduction to The Common Gateway Interface”,

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