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WHY WEB SERVICES?

EVOLUTION OF SNMP FAILED

NEW TECHNOLOGIES ARE NEEDED

WEB SERVICES MAY BECOME THE MOST IMPORTANT MIDDLEWARE TECHNOLOGY

WILL BECOME AVAILABLE ON ALL FUTURE PLATFORMS

WILL BE APPLIED FOR MANY KINDS OF APPLICATIONS

IMPLEMENTATION OF WS APPLICATIONS IS RELATIVELY SIMPLE

MANY SKILLED DEVELOPERS

MANY TOOLS

FUTURE MANAGEMENT EXPERTS CAN CONCENTRATE ON MANAGEMENT APPLICATIONS INSTEAD OF MANAGEMENT TECHNOLOGY
WHY WEB SERVICES?

SOME FACTS

MANY PROGRAMMING LANGUAGES HAVE WS LIBRARIES

PART OF DEVELOPMENT PLATFORMS: .NET, SUN-ONE, JBUILDER

WS SUPPORT INCLUDED IN WINDOWS / OFFICE

CALLING A WS FROM EXCEL TAKES 4 LINES OF CODE

COMPARE THIS TO SNMP!

THE KEY TO SUCCESS WILL BE EASE OF USE!
WHY WEB SERVICES?

THE HYPE

IRTF-NMRG
Network Management Research Group

OASIS
Web Services Distributed Management

OGSI
Open Grid Services Infrastructure Working Group

PARLAY GROUP
Parley-X

MANY RESEARCH GROUPS
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WEB SERVICES COMPONENTS

PROTOCOL STACK

MAIN W3C SPECIFICATIONS

STRUCTURE WSDL DEFINITION

OPERATION STRUCTURE

DATA TYPES

ADVANCED FEATURES
WEB SERVICES COMPONENTS

CLIENT

UDDI REPOSITORY

SOAP/WSDL

Web service

Web service

Web service
WEB SERVICES COMPONENTS FOR MANAGEMENT

"LOCAL ACCESS" REPOSITORY

A
Router

SOAP/WSDL

B
Server

C
PC

"MIB" REPOSITORY
Processes
Discovery, Aggregation, Choreography ...

Descriptions
Web Services Descriptions (WSDL)

Messages
SOAP Extensions
Reliability, Correlation, Transactions, ...

Communications
HTTP, SMTP, FTP, ...

Base Technologies: XML, Schema, ...

STACK DIAGRAM
MAIN W3C DOCUMENTS

Web Services Description Language (WSDL)
Working Drafts - Version 2.0 - 2003
• Core Language
• Message Patterns
  • Bindings
  • Requirements
• Usage Scenarios

SOAP
Version 1.2 - W3C Recommendation - June 2003
• Part 0: Primer
• Part 1: Messaging Framework
  • Part 2: Adjuncts

XML Schema
W3C Recommendation - May 2001
• Part 0: Primer
• Part 1: Structures
• Part 2: Datatypes
STRUCTURE WSDL DEFINITION

ABSTRACT INTERFACE TO THE WEB SERVICE
   Independent of a specific transport protocol and Web address

BINDING
   To associate the abstract interface with a transport protocol

SERVICE
   To associate the abstract interface with a Web address
<message name="getIfInOctetsRequest">
  <part name="community" type="xsd:string"/>
  <part name="index" type="xsd:unsignedInt"/>
</message>

<message name="getIfInOctetsResponse">
  <part name="ifInOctets" type="xsd:unsignedInt"/>
</message>

<intface name="IfDataServiceInterface">
  <operation name="getIfInOctets">
    <input message="myns:getIfInOctetsRequest"/>
    <output message="myns:getIfInOctetsResponse"/>
  </operation>
</interface>
```xml
<binding name="ifDataServiceBinding"
    interface="myns:IfDataServiceInterface">>

    <soap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
    <operation name="getIfInOctets">
        <soap:operation soapAction=""/>
        <input>
            <soap:body use="encoded" namespace="urn:..."
                encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"/>
        </input>

        <output>
            <soap:body use="encoded" namespace="urn:..."
                encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"/>
        </output>
    </operation>

</binding>
```
<service name="ifDataService" interface="myns:IfDataServiceInterface">
    <endpoint name="ifDataServiceEndpoint"
        binding="myns:ifDataServiceBinding"
        soap:address location="http://my.webservice.com/ifData/"/>
</endpoint>
</service>
MODULAR WSDL STRUCTURE

**ABSTRACT INTERFACES**

- **IF MODULE**
  - `<message ...`
  - `<operation ...`
  - `getIfTable`

- **IP MODULE**
  - `<message ...`
  - `<operation ...`
  - `getRouteTable`

**STANDARDIZED SITE SPECIFIC**

- **IF BINDING**
  - `<import IF MODULE`
  - `<binding ...`
  - `SOAP`

- **IP BINDING**
  - `<import IP MODULE`
  - `<binding ...`
  - `SOAP`

**MY MGT. SERVICE**

- `<import IF BINDING`
- `<import IP BINDING`
- `<service`
- `http://...`
POSSIBLE MESSAGE STRUCTURE

COARSE
• get(OID, instance, ...)
• set (OID, instance, ...)
  • ...

FINE
• getAll(...)
• getIfTable(...)
• getIfInOctets(index, ...)
• getIfOutOctets(index, ...)
  • ...
POSSIBLE MESSAGE PARAMETERS

NON-TRANSPARENT

getIfInOctets(index, amount)
  • Data parsed at WSDL level
  • One level of standards: WSDL
    • Less flexible
  • Easy integration with standard applications
    • Simple users (home environments)

TRANSPARENT

getIfInOctets(string)
  • Data parsed by higher level application
    • Data could be XML encoded
  • Two levels of standards: WSDL operation & XML data
    • Powerful (e.g. XPATH / XQUERY)
    • Harder to use (professional operators)
DATA TYPES

all complex types

anySimpleType

anyType

duration dateTime time date gYearMonth gYear gMonthDay gDay gMonth

boolean base64Binary hexBinary float double anyURI QName NOTATION

string

normalizedString
token

language Name NMTOKEN negativeInteger int

NCName NMTOKENS

ID IDREF ENTITY

IDREFS ENTITIES

decimal

integer

nonPositiveInteger long nonNegativeInteger

int unsignedLong positiveInteger

short unsignedInt

byte unsignedShort

unsignedByte
ADVANCED FEATURES

TRANSACTIONS
• Business Transaction Protocol (OASIS)
• WS-Coordination + WS-Transaction (BEA, IBM, MS)
• WS-Composite Application Framework (Arjuna, Fujitsu, IONA, Oracle, Sun)

SECURITY
• WS-Security (IBM, OASIS)

CHOREOGRAPHY / ORCHESTRATION
• XLANG (MS), WSFL (IBM)
• BPEL4WS (IBM, MS, BEA)
  • WSCI (SUN, ...)
  • W3C
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PROTOTYPE

• ifTable
  GetIfCell
  GetIfColumn
  GetIfRow
  GetIfTable

• gSOAP (2.3.8)

• Net-SNMP (V5.0.x) Data retrieval functions

• Debian Linux, kernel v2.4.22, 800 Mhz Pentium
<complexType name="GetIfTableResponse">
   <sequence>
      <element name="ifEntry" type="utMon:ifEntry" minOccurs="1" maxOccurs="unbounded"/>
   </sequence>
</complexType>

<message name="GetIfTableRequest">
   <part name="community" type="xsd:string"/>
</message>

<message name="GetIfTableResponse">
   <part name="-sizeTable" type="xsd:int"/>
   <part name="ifEntry" type="utMon:ifEntry"/>
</message>

<portType name="GetIfTableServicePortType">
   <operation name="GetIfTable">
      <documentation>Service definition of function utMon__GetIfTable</documentation>
      <input message="tns:GetIfTableRequest"/>
      <output message="tns:GetIfTableResponse"/>
   </operation>
</portType>
<complexType name="ifEntry">
    <sequence>
        <element name="ifIndex" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifDescr" type="xsd:string" minOccurs="1" maxOccurs="1" nillable="true"/>
        <element name="ifType" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifMtu" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifSpeed" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifPhysAddress" type="xsd:string" minOccurs="1" maxOccurs="1" nillable="true"/>
        <element name="ifAdminStatus" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifOperStatus" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifLastChange" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifInOctets" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifInUcastPkts" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifInDiscards" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifInErrors" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifInUnknownProtos" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifOutOctets" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifOutUcastPkts" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifOutErrors" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
        <element name="ifOutErrors" type="xsd:unsignedInt" minOccurs="1" maxOccurs="1"/>
    </sequence>
</complexType>
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PERFORMANCE - CPU TIME

- XML encoding 1 object: 350 µsec
- BER encoding 1 object: 70 µsec
- XML encoding 1 Table: 600 µsec
- BER encoding 1 Table: 600 µsec
- XML compression: 1000 µsec
- Data Retrieval: 2000 µsec
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gSOAP
WASP
easySOAP++
.NET
JBuilder
SunOne
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EVOLUTION OF SNMP FAILED

WE NEED REVOLUTION

WEB SERVICE IS AN INTERESTING TECHNOLOGY

MANY ISSUES STILL UNCLEAR

TOPIC FOR FUTURE RESEARCH

PERFORMANCE OF WEB SERVICES MAY NOT BE A PROBLEM