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ASP Service Performance Evaluation for Corporations

Overview

Referred to as SaaS*1 or cloud computing, corporate ASP services are coming into wide use. Because such services provide application services via a network, whether the performance assumed in application development is attained depends on the state of the network and user terminal. To deal with that problem, we developed (1) a technique for estimating the wait time experienced by the user and (2) a technique for determining whether or not a decrease in performance was caused by the terminal. These functions enable visualization of application performance and support for when performance declines in browser-based applications, which are the main type of corporate ASP services.

Features

- Applicable to applications that provide functions via the Web browser and to browser applications that use Ajax*2 and similar techniques.
- For terminals such as smartphones, tablet computers, etc. that run Web browsers as well as personal computers.
- The time from performing an operation until the desired screen is displayed (experienced wait time) can be monitored with fine granularity.
- Can distinguish terminal factors and network or server factors in the degradation of sense of presence.

Application scenarios

- End-to-end performance monitoring of corporate ASP services
  - Constant monitoring of corporate user application for sensed performance and detection of performance degradation before the customer can experience and report it, with links to pro-active improvement actions
- Use together with automated testing tools for application performance profiling
  - Combined with automated testing tools such as Apache jmeter and Road Runner, this technology can automatically determine whether an application achieves the target experienced wait time.

*1 SaaS: Software as a Service is a form of service in which software is used via a network.
*2 Ajax: Asynchronous JavaScript + XML used for dynamic updating of a part of a Web page.

SaaS, Browser application, QoE

Technology for estimating the browser APL user experienced wait time

- User operation
- Screen display completed
- Elapsed time (t)

Constant end-to-end performance monitoring of corporate ASP services

A measure of end-to-end performance; the wait time experienced by the customer is monitored and decline in service performance is detected before the customer reports it, with links to pro-active improvement actions.

Largest cause of performance decline when Ajax is used

End-to-end performance monitoring
**Multi-Layer, Multi-Domain Network Virtualization**

**Overview**

“Virtual network (VN)” technology enables path provisioning and route switchover on a single physical infrastructure simply by using GUI. A VN consists of commercial IP routers and switches connected by VLAN, LSP*, and wavelength-path technologies. By sharing the network resource and granting access to the path and route on the VN, we can help prevent competition between traffic and enable independent simultaneous operations.

**Features**

- A VN is provided as an IP network or Ethernet in response to the use of the service or application.
- The VN can increase its bandwidth and change its topology in response to changing traffic demands by dynamically setting up, deleting, and switching “paths”.
- The VN operator can set up and change the paths and routes that constitute the VN through intuitive operations on the GUI.
- A “Global VN” can be constructed by sending path provision requests to other networks by using a standard protocol.

**Application scenarios**

- Our technology provides not only communications service quickly but can dynamically respond to changes in the path architecture between data centers that correspond to the movement of virtual machines, and it can make Intercloud networks that can easily increase and decrease bandwidth.

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* LSP: Label Switched Path
Transport Network Technology

Overview

To meet the demand for high-volume communication traffic, we are working on high-speed transmission technology for 100 Gbit/s data transfer and new signal processing technology that integrates optical wavelength cross-connection (OXC) and packet switching. By implementing a 100 Gbit/s integrated transport system that applies the technology, we target the construction of a transport network that is economical, simple and energy-efficient through (1) high-speed and large-capacity traffic transport, (2) reduction of IP routing load on IP core routers, (3) improved operability from hardware integration, and (4) reduction of the NE Operation systems (NE-OpS).

Features

- Increase capacity, improve economy, simplify, and reduce power consumption for the backbone network through R&D on a new integrated transport system
- Ultra-fast 100 Gbit/s optical transmission by applying digital coherent technology
- Optical wavelength mesh network by applying OXC technology
- Packet transport network applies MPLS-TP*, which guarantees communication line quality and has maintenance and management mechanisms against failures

Application scenarios

- Backbone network of NTT Communications
- Metro network of NTT East Corporation and NTT West Corporation

Current network

Future network

* MPLS-TP: Multi Protocol Label Switching-Transport Profile
Indoor Optical Cable for Restricted Spaces

Overview

With a view to promoting optical broadband services, we are undertaking R&D for completely replacing copper telecommunications wire in multi-dwelling units (MDUs) by optical fiber. Specifically, we are working on in-building optical wiring technology for existing buildings. Indoor optical cable for restricted spaces that allows optical wiring through narrow spaces at doors and windows without the need to drill holes in walls.

Features

- This indoor optical cable for restricted spaces consists of a cord part and a sheet part applied to a small curved corner.
- Single-mode hole-assisted optical fibers (HAFs) have lower bending loss. The optical signal is effectively confined because the refractive index difference between silica and air is large.
- The iron wire of the sheet part, which is applied to restricted spaces at doors and windows, can remain bent. The sheet part can then be easily fixed by one-sided tape.
- Increasing the bending radius by using optical slant wiring can reduce bending loss and maintain reliability.

Application scenarios

- The indoor optical cables for restricted spaces enable optical broadband service to be provided in multi-dwelling units even when the owners do not permit holes to be drilled in the walls.
- We have developed single-mode HAF with lower bending-loss characteristics than those of ITU-T recommendation G.657.B3. We intend to promote optical broadband services using this optical wiring system.

Small Satellite Earth Stations for Disaster Recovery Operations

Overview

Our earth stations can be easily set up and can quickly start performing their mission in an area stricken by a disaster. Our terminals ensure a transmission speed of up to 384 kbits/s for the return link, which can simultaneously carry ten VoIP (Voice over Internet Protocol) channels. Their transportability has been greatly improved through equipment miniaturization and weight reductions. Moreover, our remote uplink access test program and two satellite auto-tracking antennas will dramatically improve the operator’s convenience.

Features

- The terminals can be applied to portable earth station systems without concern for network congestion because they use an exclusive frequency band operated by NTT East and NTT West.
- Our terminals are much more portable and convenient compared with the currently available portable earth station system.
- The equipment composition can be configured to suit the stricken area.
  - Vehicle-mounted type: Can be installed in a normal-sized car, so it can reach a stricken area quickly to help restore communications.
  - Flyaway type: Easy to carry to a disaster area because it can be broken down and packed into four separate carrying cases.
- Our terminals can start performing their mission in less than 15 minutes owing to the satellite auto-tracking function (compared with 60 minutes at present).
- The uplink access test can be executed by remote control.

Application scenarios

- Free public telephone services and web171 services (Disaster Emergency Broadband Message Board) will be provided to a disaster-stricken area.
- Free public telephone services and Internet services will be provided to an event site.

NTT Access Network Service Systems Laboratories

System configuration

Communication satellite operating in the Ku-band (12 GHz/14 GHz)

Remote control

Vehicle-mounted antenna

Flyaway antenna

Auto-tracking function

Miniaturization, weight savings

Internet

PSTN

Public telephones

Stricken area

Public Switched Telephone Network

VoIP router

Simple modem

Remote UAT*1 program

Control office

Satellite base station
Sea-Salt Corrosion Risk Visualization System

Overview

Our Sea-salt Corrosion Risk Visualization System helps maintainers easily understand the risks (sea-salt particle quantity, corrosion rate, corrosion quantity, and life expectancy) that sea-salt corrosion poses to hot-dip-galvanized steel used for sacrificial protection of aerial telecommunications structures and facilities. Our system improves the efficiency of maintenance, inspection, and renovation of structures and facilities and reduces costs by identifying regions that need special sea-salt corrosion countermeasures. The database contains sets of 2-km coastal regions, and it can be used for efficiently viewing vast regions under different weather conditions.

Features

- Modeling of corrosion analysis functions based on the results of exposure experiments conducted in Japan under different meteorological and geographical conditions.
- Use of robust statistics and nonlinear least squares method providing over 30% improvement in estimation accuracy compared with the previous method.
- Four different risks modeled (sea-salt particle quantity, corrosion rate, corrosion quantity, and life expectancy).
- Intuitive understanding of risk distributions through geographical visualization.
- Comparisons of life expectancy enabled by changing parameters in relation to the initial film thickness of hot-dip-galvanization and/or corrosion wastage percentage.

Application scenarios

- Corrosion risks visualized on a map to help:
  - select optimal regions for sea-salt-corrosion countermeasures.
  - improve efficiency by optimizing maintenance inspections and renovation periods.

Our system estimates sea-salt corrosion risk (SCR) factors by using corrosion analysis functions and topological and meteorological DBs.

Corrosion Analysis Functions

The “Corrosion analysis functions” are based on the long-term exposure experiments conducted on the seashores of Japan. Their model parameters have been optimized by using a robust, nonlinear least-squares method.

Input learning data

SCRs

1. Sea-salt particles (SP)
2. Corrosion rate
3. Corrosion quantity
4. Life expectancy

Quantities for analyzing the SCR

- wind, distance from seashore
- SP, temperature, precipitation, dew duration, corrosion rate
- corrosion rate, initial film thickness

Definition of SCRs

- SP quantity
- Distance from seashore
- Quantities: wind, dew, temperature, precipitation
- Metal (galvanized zinc, carbon steel)
- corrosion quantities of film thickness attenuation
100-Gbit/s Optical Transmission Field Trial Using Digital Signal Processor

Overview

We have developed the world’s most advanced digital signal processor (DSP) for 100-Gbit/s optical transmissions over high-speed, large-capacity optical transport networks. The DSP compensates for the degradation of signals transmitted across long distances and has a chromatic dispersion estimation function which enables fast link-up when switching optical routes. We conducted 100-Gbit/s optical transmission field trials using the DSP and confirmed its excellent performance.

Features

- 100-Gbit/s optical transmission using a large-scale integrated DSP and a polarization division-modulation quadrature phase shift keying (PDM-QPSK) modulation scheme
- Second-generation DSP equivalent to a supercomputer (100 M gates DSP)
- Fast and accurate chromatic dispersion estimation
- Link-up faster than the ITU-T standard switching time (50ms)

Application scenarios

- Next-generation 100 Gbit/s backbone optical transport network
- Future metro optical transport network

- This work is partly supported by R&D of “High-speed Optical Transport System Technologies” and “High-speed Optical Edge Node Technologies” by the Ministry of Internal Affairs and Communications (MIC) of Japan.
- This work is partly supported by the “Universal Link Project” of the National Institute of Information and Communications Technology (NICT) of Japan.
Programmable Network Virtualization Technologies for Future Networks

Overview

Network applications have various requirements, and network infrastructures should be versatile enough to dynamically create various network services for them. NTT has been researching and developing innovative management technologies that use virtualization to allocate virtual networks that isolate resources in order to create their services.

Features

- Virtual network for each application (Slice)
- Adaptive control of resource allocation to suit an application’s processing requirements
- Interference among virtual networks prevented by resource isolation
- Advanced network equipment (VNode) with a high level of programmability for creating novel networking and computing systems
- Slice design that describes a slice’s resource requirements and hides the implementation

Application scenarios

- High-speed network for the media industry
- Highly reliable network for medical work applications
- Highly private network for digital home appliance services

This handout includes research results achieved by the “New generation network R&D program for innovative network virtualization platform and its application”, which was research commissioned by the National Institute of Information and Communications Technology (NICT).