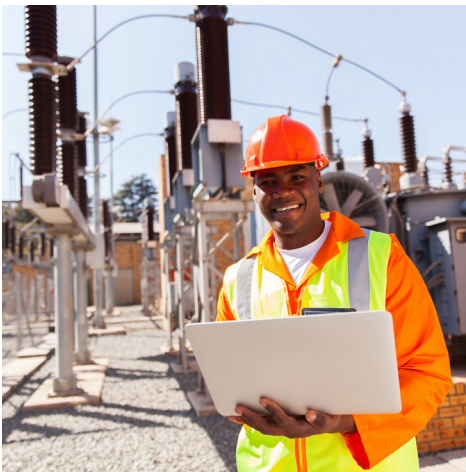


Application Note

Performance Assurance for Teleprotection Networks

Ensuring quality-of-service for critical infrastructure



Application Benefits

- Unified, network-wide view
- Multilayer, multivendor solutions
- Organized, actionable data
- Predictive analytics
- Reduced time to repair
- Customizable performance metrics
- Root cause identification and notification
- User role customization
- Template-driven workflows

Functional Elements

- vSure® service assurance platform, configured to support the existing teleprotection network
- Teleprotection network
 - Routers
 - Teleprotection relays
 - Optical transport

A cornerstone of every utility's operation is the communications network that enables continuous monitoring, control, and management of the power grid. From generation facilities to customers, every stage of the power delivery process is monitored on a 24/7/365 basis. This comprehensive set of real-time control and monitoring mechanisms, known as teleprotection, allows utilities to quickly isolate failures and reroute power, ensuring uninterrupted delivery.

Modernizing for Higher Demands and Higher Standards

Since every day-to-day aspect of business, public life and government depends upon electricity, these utility teleprotection networks must be extremely reliable, resilient, low-latency, and increasingly, self-healing. Technological advances that reduce the need for human intervention, such as substation automation, have caused a leap in demand for higher bandwidth and more sophisticated network operations and management. Additionally, security concerns have led utilities to add alarms and video monitoring to their communications network applications, which has also added to the overall demand.

The Rise of Packet Technologies

For several decades, utilities have predominantly depended upon SONET as the foundation of their networks. While this stable, dependable technology has proved its value, legacy networks present significant operational, management, and budgetary challenges. Disunified networks, for instance, require multiple management system logins, which complicates recordkeeping and troubleshooting; the result is often abundant data with little insight.

In recent years, growing demand for higher performance, reliability and versatility has created a climate of change throughout the communications network industry. Many utilities are modernizing their networks by making the transition to packet-based networking. Several technologies are available as the basis for packet networks, including Multiprotocol Label Switching (MPLS), provider bridging, Provider Backbone Bridging (PBB), and Carrier Ethernet.

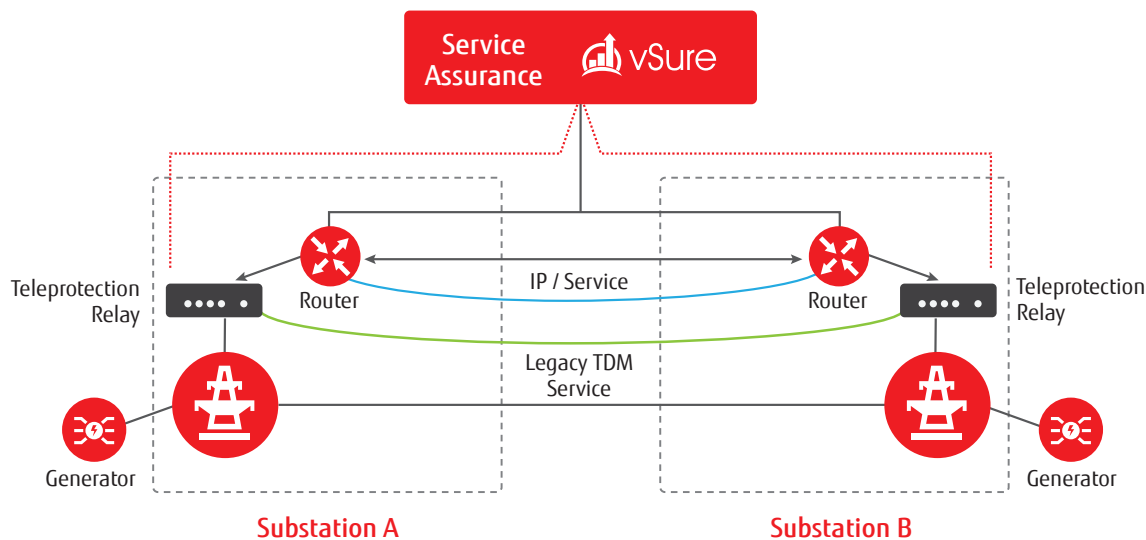
The Challenges Facing Utilities

As we head towards 2020 and beyond, utilities will need to address challenges that arise not just from new networking technologies and architectures, but also from the changing nature of the grid itself. Over the next few years, the power grid will be increasingly volatile and distributed while simultaneously becoming more of a target for security breaches and cybercrime.

From the network technology standpoint, the inevitable move to packet technology will bring with it consequences, particularly in the form of issues involving jitter and delay. Packet networks introduce new causes of delay, such as buffering, that can cause inconsistencies in delay across the service. Known as asymmetric delay variation, this phenomenon can adversely affect teleprotection, since the teleprotection function depends on symmetrical delays in order to synchronize time accurately. Asymmetric delay variation can ultimately cause damaged power lines or unnecessary outages.

Packet technologies also bring an increased vulnerability to "false trip" events caused by asymmetric delay variation. A teleprotection application must prevent these as far as possible, since false trips can lead to unnecessary and potentially costly downtime and troubleshooting.

A Dependable Teleprotection Network



Teleprotection service assurance from the relays to your transport switches and routers, regardless of media or protocol.

Multilayer, Multitechnology Service Assurance

vSure service assurance software is the basis of the Fujitsu Performance Assurance Application for Teleprotection. The application centralizes and simplifies service assurance and SLA management on your existing teleprotection network. Overall, the application delivers multilayer, multitechnology service assurance on Layer 0–3 devices, in addition to comprehensive support for SDN and NFV technologies. Fujitsu network integration experts work with you to ensure the application precisely meets your requirements. The combination of vSure with Fujitsu network expertise provides the essential up-to-the-minute metrics you need to keep your teleprotection network operating smoothly.

vSure – Modular, Next-Generation Software

vSure is a modular software system that can dramatically improve network performance, SLA conformance and overall quality. vSure offers a single solution for managing any infrastructure: network, systems, applications, facilities, and security. vSure's modules cover fault management, performance management, and service analytics. An extensive off-the-shelf library of plug-ins is also available to monitor physical and virtual devices. The vSure software monitors parameters important to teleprotection such as delay, delay variation, packet loss, and jitter buffer. vSure also tracks and records historical trends and provides notification of any metrics that fall outside the designated thresholds. Rather than incurring the delays that result from sifting through hundreds or thousands of alarms, vSure's root cause analysis pinpoints fault location, speeding service restoration, reducing truck rolls, and improving customer satisfaction.

Application Highlights

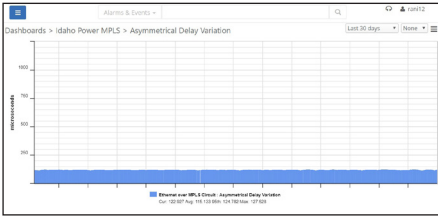
- Ensures jitter is within acceptable limits
- Prevents false trips due to asymmetric delay variation
- Assists in maintaining performance to SLA standards
- Reduces the number of management tools needed
- Promotes simpler network operations
- Improves network visibility
- Increases predictability
- Ensures consistent performance

Key elements of vSure are:

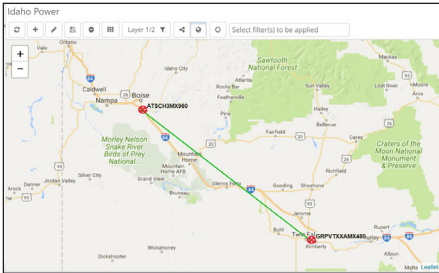
- Customizable dashboard for users and groups
- Real time dashboard information on topology, alarms, events, and service visualization
- Standard and custom reports available
- Performance anomaly detection using machine learning
- Trend analysis
- Threshold crossing alarms
- Configurable notifications and automations

A Multilayer, Multitechnology Solution

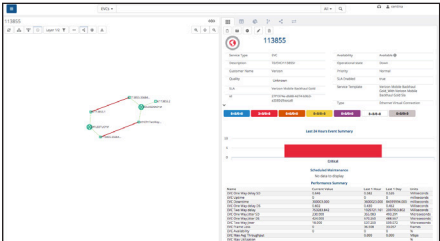
Asymmetrical Delay Variation on MPLS Circuit



Network Topology



Service Performance Metrics



vSure provides comprehensive reports and dashboard views of key performance indicators and other metrics

Key Performance Indicators (KPIs)

vSure monitors a wide range of KPIs in real time, using customized normal values for all metrics, and provides alerts when out-of-normal values are encountered. vSure’s intuitive user interface provides dynamic views of service, device and interface performance measurements.

Examples of typical normal values for teleprotection are:

- Delay: 50 ms
- Delay Tolerance: 50 ms
- Latency Asymmetry: 4 ms
- Error Rate: 0.5 percent
- Jitter: 3–4 ms

Why Fujitsu?

Communications networks are moving towards an interoperable, multivendor future. Utilities must therefore navigate a period of transition and growing demands, in terms of both the functional capabilities and architecture of their networks, and the overall modernization of the power grid.

Fujitsu has approached this time of transition by embracing next-generation technologies and standards. We select best-of-breed partners and technologies and incorporate these into the Fujitsu partner ecosystem, providing a range of choices in meeting specific customer needs. Similarly, we take a partnership approach to customers, and will work with you to co-create new approaches and services to support the power grid of the future.

As networking experts, we put decades of experience to work by assuming multivendor network integrator and architect responsibilities. Our team will help you meet the challenges ahead—providing efficient, timely project communication and coordination; ensuring your project is planned and executed on time; minimizing financial and other risks; and proactively resolving issues when they arise.

In addition to our networking expertise, Fujitsu’s global capabilities encompass a wealth of IT and networking innovations that can add real value to your outcomes.