Building and Adjusting Service Level Agreements

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Whichever the mode of provisioning of telecom services in the Electrical Power Utility (EPU), and the relationship between the service user and provider (formal, semi-formal, or implicit) it is essential to assure a common understanding of the qualities and attributes of the delivered service. The contractual document that reflects these attributes as well as the obligations and liabilities of the service provider toward the service user is the Service Level Agreement (SLA).

An SLA allows the service user to express the operational constraints of its application as defined in the previous sections to the telecom service provider and to obtain the provider's assurance that the delivered service shall meet these requirements.

An SLA allows also the service provider to define the network resources and management processes that he must use in order to meet his contractual obligations towards the service user. Furthermore, the service provider may use the SLA toward his service customers in order to specify the level of service that he expects from his contractors and providers (e.g., underlying infrastructure or support services).

Finally the SLA allows the service provider to know what obligations the service user must meet so that the service can be delivered and maintained by the service provider. Examples may include the provision of racks or floor space for the service provider's equipment, the provision of AC or DC power, access during and out of office hours, third party insurance coverage, etc.

The precision and the exhaustiveness of the SLA become particularly important when the provider is multi-customer and multi-service and the more we move toward a fully procured telecom service.

C. Samitier (ed.), *Utility Communication Networks and Services*,
CIGRE Green Books, DOI 10.1007/978-3-319-40283-3_10

SLA Parameter	Description / Comments
Interface type	As required by the application, (e.g. Optical Ethernet, G703, RS232). Choosing a physical interface such as Ethernet that can be scaled remotely results in easier expansion of services as the need grows.
Bandwidth and throughput	Guaranteed minimum and Peak bandwidth available to the service and degree of flexibility
% number of packets allowed per service for each procured Quality of Service (QOS) level.	It is important to set a policy at the edge of the EPU network to avoid exceeding the allowable limits, otherwise the policy on entry to the Service Provider's network with either drop the packets or remark them to the least priority service, leading to poor service performance due to oversubscription of the service by the EPU itself. Conversely you want to see the Service Provider to apply limiting policies on entry to their network in order to protect the EPU service from contention due to oversubscribed services from other Service Provider customers.
Time Latency (end-to-end delay)	For packet based services, these need to be defined for each class of service. Voice services for example will be processed via separate low latency queues.
Delay Variation (Jitter)	For packet based services these need to be defined for each QOS level. As is the case with most data service parameters these are usually expressed by the Service Provider as monthly averages. Consider how to manage the situation of high peaks that don't cause the monthly averages to exceed the Service Provider specifications. (High peak jitters can cause voice degradation or network convergence problems and still not hit the monthly average parameters.)
Go-Return delay difference	For certain protection relay communications. Asymmetrical delay will cause certain protection schemes to fail.
Service Restore Time on network change	The time required for automatic reconfiguration mechanisms to act upon the network and hence to restore service (e.g. Spanning Tree Protocol, SDH Ring Protection restore time, etc.)
Availability	Distribution, frequency, duration, and timing of service failures.
Integrity and Packet Loss	Specified for each procured class of service.
Power Faults Correlation	Critical services not impacted by power system disturbances. Precautions for not losing service during disturbance.
Resilience and Routing Control	Control of the provider on the routes taken by services in normal time and on anomalies (determines the capability of establishing duplicated communications without common point of failure). The Service Provider and Service User need to agree on the routing protocol between their networks, and to set various metrics that impact on the resilience of the interconnected networks.
Power Autonomy	The time duration for which the service can be delivered in case of A.C. power outage
Maximum Time to Restore Service	Service Provider's ability to respond to service failures and carry out the necessary repairs within the maximum specified time. Different times will be defined for urban, regional, rural and remote locations depending on the location of Service Provider maintenance staff.

Fig. 10.1 SLA checklist for EPU procuring telecom connectivity services

SLA Parameter	Description / Comments
Dual Route Independence	Ability to guarantee that specified connections between two points never use a same equipment, cable segment, power supply, or cable conduit.
Physical redundancy check	Specify the level of redundancy required for example at network level, equipment level, or at specific locations.
Service Isolation & Security	Isolation between internal and external traffic, as well as between different internal services. Measures deployed by the provider to protect against the risks of interfering third parties (confidentiality, denial of service, integrity of information). An EPU will usually have to regard a Service Provider as "untrusted" and employ security techniques such as encryption.
Access Arrangements	Most EPUs have special rules for site access for security and safety reasons. These need to be communicated to the Service Provider and factored into his support of the service.
Qualified/ Certified/ Insured Workforce	Ensure that the Service Provider has sufficient depth in its workforce with the right number of personnel in the right locations to ensure that response time guarantees are realistic. Ensure appropriate insurances are in place to cover accidents by the Service Provider workforce when attending an EPU site.
Performance Reports / Fault Notification	Meaningful and comprehensible information to be provided in a timely fashion. An EPU should consider implementing their own monitoring tools to ensure the performance of the Services is appropriate. This is especially important for packet based services using different QOS levels.
Penalties and Liability	While penalties may not compensate for loss of critical services, they do focus a Service Provider's attention on the need to accurately monitor the SLA guarantees. Usually a Service Provider will exclude responsibility for contingent liabilities and cap their overall liability to a percentage rebate of fees paid. It is worth considering inserting a termination clause in the SLA that allows termination of the service for a sustained poor performance. At least this enables an EPU to engage a new Service Provider and potentially fix the problem using a different service if the current Service Provider continues not to remedy the problem.
Other Legal Conditions	Depending on the structure of the contracts (e.g. if there is a separate service provision contract or not) there may be other legal conditions that may need to be covered off in the SLA including details for; confidentiality between the parties, intellectual property, compliance with all applicable laws (and governing law where the service is provided cross jurisdiction), acceptance and payment, Force Majeure and Termination of contract provisions to name the most common ones.

Fig. 10.1 (continued)

However, very often multi-customer telecom service providers such as public telecom operators provide a catalog of standard SLAs, none of which may meet the requirements of the EPU. Standard "Operator SLAs" are usually not sufficiently

	1 Lowest Severity	2 Low Severity	3 High Severity	4 Highest Severity
Operational Coverage	Control Centres & Corporate Sites	Plants and stations & Control Platform	Along the grid (e.g. workforce)	Beyond the grid, (Energy farms, customer sites, etc.)
Time Latency	1 – 5 sec Human operator	0.1 – 1 sec	Few cycles (20 - 100 msec)	Fraction of a cycle (5 – 20msec)
Time Predictability, Delay Variation	Seconds	0.1 – 1 sec	10 – 100 msec	1 – 10 msec
Delay Asymmetry (go-return path)	May be through different telecom media	Uncontrolled over the same telecom system	Controlled Routing	Identical path, 200μs
Restoration Time	Few Hours	Few Minutes	Few Seconds	100 msec or less
Availability	99%	99.9%	99.99%	99.999%
Service Survivability & Resilience	Service may be lost in the event of anomalies	Survives one module or one link failure	Survives loss of one node or few links	Survives major system faults & disasters
Security Domain	Public	Un-trusted	In Confidence	Protected
Service Integrity	Lost data recovered (Acknowledge & Retransmission)	Not so sensitive to recurrent data error & loss	Tolerates some data loss	High data integrity is critical
Sustainability, Life-cycle Mgt.	Continuous upgrade (type IT)	Yearly upgrade	Multi-annual upgrade (Planned migration)	Constant over application asset lifetime
Environmental Class	Customer Premises Admin Building Control Centre	Power plant / Substation (Control & Relay Rooms)	HV Grid corridors Proximity of HV	Switch-yard Hydraulic Structure

Fig. 10.2 Constraint severity notation criteria

precise to guarantee the fulfillment of operational constraints as described previously and the service provider may not be prepared to review his entire network's operation mode and operational process to meet one customer's requirements. In this case, assessing the most appropriate SLA of the provider against the operational constraints of the EPU applications allows the estimation of the gap and the risk analysis associated to the potential impact of this gap. The following checklists given in Figs. 10.1, 10.2 and 10.3 have been prepared to serve utilities for specifying or assessing SLAs in the EPU operational context.

	Applications / Requirements	Coverage	Time Latency	Delay Variation	Delay Asymmetry	Restoration Time	Availability	Survivability	Security Domain	Service Integrity	Life-cycle Mgt.	Environment Class
Operational Applications	Protection Communications Current Differential	2	4	4	3-4	4	4	4	4	4	4	2
	Protection Communications State Comparison (command)	2	3	3	3	4	3	4	4	4	4	2
	System-wide Protection (WAP&C)	2	2-3	3	3	4	4	4	4	4	4	2
	Remote substation control	2	2	2	2-3	3	2	3	4	4	3	2
	Operational Telephony	2	2	2	2	3	2	3	4	2	3	2
	SCADA RTU	2	2	2	2	3	2	2	4	3	3	2
	Generation Control Signaling	2	2	1	1	3	2	2	4	4	3	2
	Inter-control centre communication	1	2	1	2	3	2	2	4	1	1	1
	Remote Operator	1	1	1	2	3	2	2	4	1	1	2
	Synchrophasor visualization & monitoring (WAMS)	2	1	1	1	2	1	2	4	2	3	2
	Settlement and Reconciliation metering	2	1	1	1	2	1	1	3	3	3	2
	Smart Metering	4	1	1	1	1	1	1	3	1	3	1

	Applications / Requirements	Coverage	Time Latency	Delay Variation	Delay Asymmetry	Restoration Time	Availability	Survivability	Security Domain	Service Integrity	Life-cycle Mgt.	Environment class
Operation Support	Mobile Workforce Communications	3	2	2	2	2	2	4	1-2	2	1-2	4
	Collaborative Multimedia Comms.	2	2	2	1	1	1	2	2-3	1-2	1	1-2
	Automation Device Management	2	1	1	2	2	1	2	4	3	3-4	2
	Substation Data Retrieval	2	1	1	1	1	1	1	4	1	1-2	2
	On-line Documentation	2	1	1	1	1	1	1	3-4	1	1	2
	Condition Monitoring	2	1	1	1	1	1	1	3	1-2	3-4	2
Security & Safety	Video-surveillance of sites	2	1	1	1	1	1	3	3-4	2	3	4
	Site Access Control	2	1	1	1	1	1	4	3-4	1	3	2
	Environment Hazard Monitoring	2	1	1	1	1	1	4	3-4	1	3	2
	Intruder Detection	2	1	1	1	1	1	4	3-4	1	2-3	3-4
	Isolated Worker Safety	3	1	1	1	1	1	4	3-4	1	3	3-4
	Public Warning Applications	4	1	1	1	1	1	4	3-4	1	3	4
	Hydraulic Stress O&M	2	1	1	1	1	1	4	3-4	1	3	4
	Cyber-security Applications	2	1	1	2	1	1	4	4	1	1-2	2

Fig. 10.3 Typical communication service requirements for power utility applications

Figure 10.3 titled "Typical Communication Service Requirements for Power Utility Applications" provides a cross reference of typical service requirements for utilities' applications. The reader should use Fig. 10.2 for characterizing the severity levels 1, 2, 3, and 4 in Fig. 10.3.