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SERIES L: ENVIRONMENT AND ICTS, CLIMATE
CHANGE, E-WASTE, ENERGY EFFICIENCY;
CONSTRUCTION, INSTALLATION AND PROTECTION
OF CABLES AND OTHER ELEMENTS OF OUTSIDE
PLANT

**Data centre infrastructure management system
based on big data and artificial intelligence
technology**

Recommendation ITU-T L.1305

ITU-T

ITU-T L-SERIES RECOMMENDATIONS

**ENVIRONMENT AND ICTS, CLIMATE CHANGE, E-WASTE, ENERGY EFFICIENCY; CONSTRUCTION,
INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT**

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Recommendation ITU-T L.1305

Data centre infrastructure management system based on big data and artificial intelligence technology

Summary

Recommendation ITU-T L.1305 contains technical specifications of a data centre infrastructure management (DCIM) system, with the following aspects being covered: principles, management objects, management system schemes, data collection function requirements, operational function requirements, energy saving management, capacity management for information and communication technology (ICT) and facilities, other operational function requirements and intelligent controlling on systems to maximize green energy use.

Other aspects such as maintenance function requirements, early alarm and protection based on big data analysis and intelligent controlling on systems to decrease the cost for maintenance are also considered.

History

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Artificial intelligence (AI) technology, big data, DCIM, functional requirements.

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Introduction

Full-stack cloud technology is becoming increasingly popular among industry users in this the second decade of cloud computing technology. Full stack cloud platforms bring converged solutions for enterprise digital transformation across numerous areas, including microprocessors, hardware and software to help customers achieve a more comprehensive, flexible and long-term evolution cloud platform to help them achieve their business goals. Full-stack cloud platforms, in the era of the large-scale application of high-density servers, all-flash storage and fabric networks with sharply increased power density, imposes higher requirements on infrastructure reliability as described in [b-ITU-T Y.3500]. For example, infrastructure faults must be quickly identified, isolated and self-healed to prevent impacts on Internet technology (IT) service. In addition, with the migration and adjustment of IT loads on the cloud platform, power fluctuations will become the norm and precise and dynamic cooling technology will become the direction of development. Therefore, in the era of full-stack cloud platforms, data centre infrastructure and IT systems need to be converged and collaborate to break the boundaries of existing data centres. Building a full-stack cloud data centre must include resource convergence, data intelligence and service innovation to ensure high availability and energy saving of IT services.

An intelligent management system performs deep machine learning based on data centres of different types and the working conditions of different devices. It identifies optimal policies and helps data centres run more efficiently. For example, using massive data analysis techniques, conducting in-depth analyses of each component (and of key components) of the power supply and distribution system of the data centre, proactive detection and early warning of traditional passive faults can be handled by proactive risk prevention where faulty components are isolated and the fault impact scope is automatically reported to the IT system. In addition, out-of-warranty component reminders can be sent to procurement personnel in advance in order to reduce the risks of alarms and major accidents and prevent IT services from being affected. As another example, an artificial intelligence (AI) algorithm, such as a deep neural network, can be used to implement automatic control and optimization of a data centre temperature control system in combination with real-time analysis and prediction of power consumption requirements of an IT service so as to implement optimal working conditions of the heat load of the IT equipment, the cooling output of the temperature control indoor unit and all links of the outdoor cooling station, greatly reducing the power consumption of the data centre.

In reviewing the development history of the past few years, it was found that data centre infrastructure management (DCIM) systems often encountered delivery difficulties. Rollout times were pushed forward and application delivery was difficult to achieve. Primarily this was because the integration and deployment of DCIMs are complex, typically involving the interconnection and commissioning of a large number of devices and systems. System deployment periods usually span several months or even a year, and system deployment risks are difficult to control. In addition, while the intention of DCIMs is to reduce risks, improve efficiency, improve capacity prediction and enhance service agility, they are often limited by the data integrity and availability at the bottom layer. Thus it is difficult to build a complete business flow in actual projects that can help users achieve their business goals.

Recommendation ITU-T L.1305

Data centre infrastructure management system based on big data and artificial intelligence technology

1 Scope

This Recommendation describes specifications of a data centre infrastructure management (DCIM) system based on big data and artificial intelligence (AI) technology. The system will manage all infrastructure in the data centre at the same time through a comprehensive platform.

The scope of this Recommendation includes:

- network infrastructure of management systems;
- standardization of data collection of the installed module;
- interconnection among various kinds of monitoring sub-systems;
- requirements for different functions in a DCIM.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

None.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 data centre infrastructure management (DCIM): A data centre infrastructure management (DCIM) system that provides real-time monitoring of all data centre infrastructure that support correctly operating information and communication technology (ICT) devices. The purpose of a DCIM is to manage all types of infrastructure, including uninterruptible power supply (UPS), air conditioning, power distribution unit (PDU), etc., simultaneously, within a unified platform. The operation efficiency of the data centre would be maximized and the stability would be promoted through analysing and classifying the relevant data.

3.2.2 full-stack cloud: A solution that implements all possible cloud levels.

NOTE – Based on Annex A of [b-ITU-T Y.3500].

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AI	Artificial Intelligence
app	Application
BMS	Building Management System
B/S	Browser/Server
COP	Coefficient of Performance
DCIM	Data Centre Infrastructure Management
DDC	Data Device Controller
DNN	Deep Neural Network
ICT	Information Communication Technology
IDC	Integrated Data Centre
IoT	Internet of Things
IMEI	International Mobile Equipment Identity
IT	Internet Technology
KPI	Key Performance Indicator
NFC	Near Field Communication
NMS	Network Management System
O&M	Operation and Maintenance
OPC	Open Protocol Communication
PAD	Packet Assembler/Disassembler
PaaS	Platform as a Service
PDU	Power Distribution Unit
PLC	Programmable Logic Controller
PMS	Power Management System
PUE	Power Usage Effectiveness
QR	Quick Response
RoI	Return on Investment
SPCN	System Power Control Network
SaaS	Software as a Service
UPS	Uninterruptible Power Supply

5 Conventions

None.

6 Structure of DCIM system

The data centre infrastructure management (DCIM) system collects relevant data such that basic collection and transmission devices can be comprehensively used to access the uniform monitoring DCIM platform to interconnect different types of monitored items. A possible structure for a DCIM system is shown in the Figure 1. This figure illustrates an example of structure, however, not all subsystems need to be present but may be merged into larger subsystems.

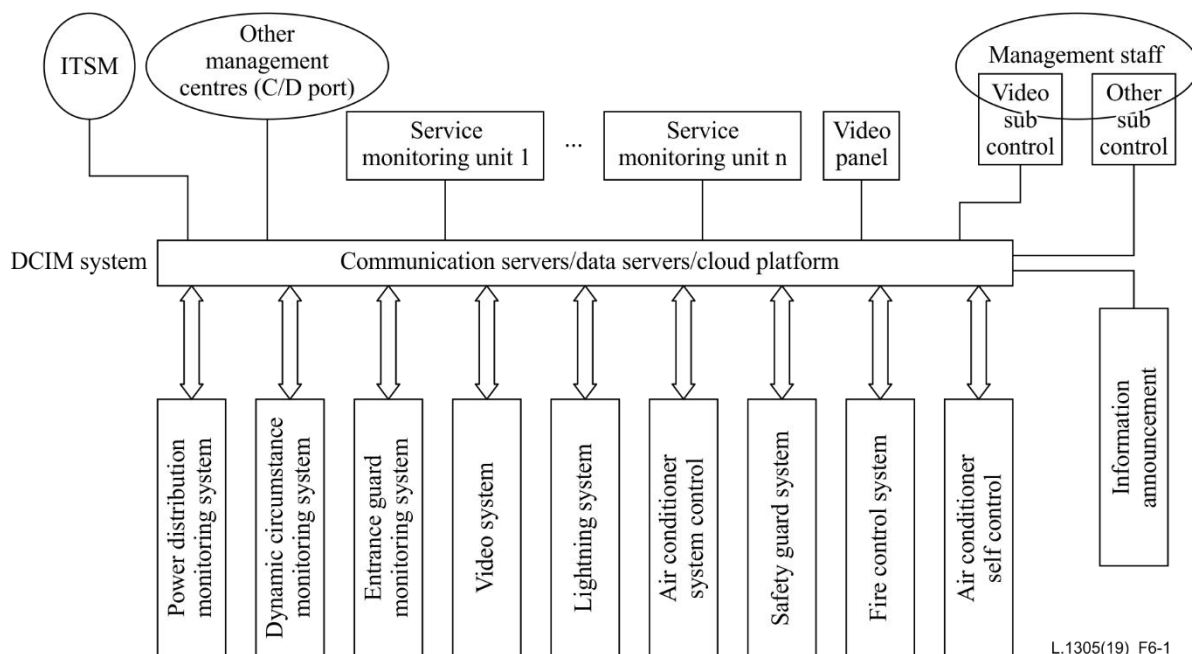


Figure 1 – Example structure of a DCIM system

When some subsystems are required to be designed, it is better to use a system-access mode where various port protocols are allowed in order to connect different subsystems to the whole DCIM. Examples of different types of port protocols include open protocol communication (OPC), building automation and control network (BACnet), etc. It is common to construct subsystems in most integrated data centre (IDC) rooms. An alternative management system structure is shown in Figure 2; this figure illustrates an example in which some subsystems are not connected directly to servers but rather, a site data collecting system is present. This configuration has the functionality to convert different protocols used by the server, perform some operations and control some infrastructure equipment.

Some of the subsystems included in both figures are:

- Information announcement: corresponding to all systems dedicated to distribute information inside the data centre, such as display, acoustic announcement, etc.;
- Air conditioner self-control: the part of DCIM dedicated to automatically control the cooling infrastructure inside the data centre, automatically regulating the functionality status to obtain the temperature and humidity necessary for the correct operation of the data centre;
- Fire control system: controls the fire detection inside the data centre and manages the fire extinguishing solutions;
- Safety guard system: controls all parts linked to data centre security;
- Air conditioner system control: controls the setting of temperature inside all data centre buildings;
- Lightning system: controls the lighting inside the data centre;