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Design for the Emergency Command Information System Architecture of Ocean Oil Spill

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Abstract

On the basis of defining the Ocean Oil Spill Information Services and in order to improve the efficiency of disposal and command of more frequent ocean oil spill accidents, the SOA (service oriented architecture) and P2P (peer-to-peer) are utilized to design the physical framework and functional framework of the emergency ocean oil spill command information systems. The goal in this is to study the composition and structure of each framework. The emergency command information system of ocean oil spill is built on C^4ISR (command, control, communication, computer, intelligence, surveillance and reconnaissance) architectural framework that is composed of command view, system view, and technology view. The physical framework of the command information system architecture is characterized by a multi-layer structure. The node is divided into LSP (local service peer), GSP (group service peer) and CSP (common service peer). Each system and software set can be encapsulated as part of the Ocean Oil Spill Information Services, with each service being capable of serving as a local service node. Furthermore, each local service node participates within a peer group. According to the service purpose and granularity, the functional framework is divided into physical resource layer, data layer, support service layer, application layer. Data layer mainly includes communication protocol, message format, data type, and various database, etc. Support service layer includes storage management service, information distribution service, service management, human-computer interactive service, resource sharing service and information security service, etc. Application layer includes situation generating service, emergency plan service, emergency command service, emergency assessment service, communication support service, navigation and positioning service, etc. We draw conclusions that the information system architecture proposed in the paper has more prominent reliability and flexibility through contrastive analysis of similar information system architecture, and lay foundations for research intoocean oil spill service-oriented command information systems.

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1. Introduction

Ocean oil spill emergency command information systems are integrated emergency command information systems that form upon the basis of layering and combining multiple subsystems or functional modules including command scheduling, emergency monitoring, information analysis, and trend prediction. It is a system of systems, in which each subsystem is quite complex, having its own user interface and database, or even having different functions. However, these each run upon different platforms (Ivanov A. et al., 2008). Layered instruction requests and multi-layered pyramid command systems geared toward passing emergency instructions difficultly efficiently achieve emergency command decision-making in traditional ocean oil spill emergency command. With the development of information technology, however, decreases to intermediate command layering make fast, flexible, effective and integrated command systems possible for ocean oil spills.

The integrated command information systems of ocean oil spills is a complex information system based on 3S technology (GNSS, GIS and RS). These technologies require information between information systems to be efficiently exchanged and integrated, and information resources to be shared in real time. Emergency information resources must also be capable of interconnection, interchange, and interoperation. In addition, corresponding interoperation must be capable of implementation between subsystems to obtain a unified information view of the entire field of the oil spill. Namely, the system must be able to quickly and flexibly calculate reconstruction so as to adapt to emergency site conditions and rapidly changing emergency actions. All of these requirements reveal that the emergency ocean oil spill command information systems must offer a distributed system which supports distributive ability, autonomy, mobility, interactivity and self-adaptivity.

In addition to data resources, services and SOA (service-oriented architecture) are utilized to effectively encapsulate and integrate distributed and heterogeneous application within the organization. Service composition is utilized to rapidly build complex cross-organizational applications that are adaptive to the changes of environment, user needs, and business processes. These are such which have become the mainstream trends in distributed computing technology in recent years. In the United States, network-centric warfare (global information grid, GIG) is focused on realization of on-site information sharing as well as integrated command and control. To these ends, it has developed basic information systems represented by the NCES (net-centric enterprise services) system and the SoSCOE (system of systems common operating environment). The SOA has likewise been utilized to construct emergency application systems quite similar to the NECC (net-enabled command capability) system. A new service view is added in the recently released U.S. defense architecture framework DoDAF2.0. In China, research related to service-oriented emergency on-site command information systems have likewise been carried out in numerous fields, and great progress has thus far been recorded (Colagrossi A st al., 2003. Shen T et al., 2008. Wang S D et al., 2010. Yang X F et al., 2012.).

In the paper, based on the definition of ocean oil spill information services , SOA (service-oriented architecture) and P2P (peer -to-peer) are used to design a physical framework and functional framework for emergency ocean oil spill command information systems, and further proposes a composition and structure of each framework.

2. Ocean Oil Spill Information Services, SOA and P2P

2.1. Ocean oil spill information Services

As an emerging network application model, internet services are a new distributed computing model. This model is characterized by loose coupling, strong autonomy and cross-platform invocation among other traits. The service-