A COMMON APPROACH TO SWITCHING IN TACTICAL TRUNK COMMUNICATIONS SYSTEMS

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Abstract. Battlefield communications systems should be simple, flexible and secure. The demand for managed Quality of Service (QoS) across a diverse range of services at varying security levels places significant strains on traditional trunk communications models. A more flexible link-layer switching architecture that can employ payload encryption is required. This paper proposes a change in the way that the trunk network should be viewed instead by seeing it as an unclassified common service infrastructure to carry all services. Additionally, more and more services are being sourced from the strategic network. Traditionally, the mobile and fixed architectures do not match, but a common approach to the underlying switching could solve this problem. This paper recommends Asynchronous Transfer Mode (ATM) as the protocol to meet these requirements.

INTRODUCTION

Trunk communications for land operations have traditionally provided voice (telephony), messaging systems and latterly data networks down to formation level within a corps structure. The Australian situation, especially in dispersed operations, is significantly different to traditional operational concepts. Independent, dispersed brigade-level operations with large areas of operation do not match well with traditional trunk solutions. In such a scenario, linkages into the strategic communications base become more important, and will be conducted at a lower organisational level. To some extent this challenge is also being faced by other modern armies, for instance with deployments in Kosovo and Bosnia.

Over and above the operational concept changes, there has been a rapidly increasing demand for data services over the trunk communications. The pace of these changes has not been universally matched by developments in the trunk communications systems. In the Australian example, many projects have created their own protocol stack and associated equipment to solve independently the communications challenge that should have been met by a common trunk communications system. The advent of new technologies and the opportunity to adapt trunk approaches leads to a need to reconsider the composition of the trunk system.

In this paper we seek to examine the purpose of the trunk system, consider technical approaches (particularly overseas models) to meeting the purpose and propose a new trunk architecture.

PURPOSE OF TRUNK COMMUNICATIONS

Figure 1, slightly adapted from [1] and [2], seeks to put the trunk system into the context of the entire Land Communications Architecture. The architecture proposes a heterogeneous but interoperable system of communications systems with different elements to meet the disparate needs of land forces, for instance combat radio sub-system to provide highly mobile, all-informed communications.

Figure 1 is not strictly a Systems Architectural view in accordance with the C4ISR architectural framework [3] since the allocation of systems to operational entities is implicit. As discussed in [2], the trunk system provides the gateway between the strategic communications system and deployed elements. It is deployed down to at least brigade (task force) level, with potential for extension down to unit level. The trunk system provides voice (telephony) and messaging systems along with increasing support for data services. For management and the most effective sharing of limited bandwidth, these services should travel over a “converged” network capable of carrying all communications services both real-time (voice/telephony, interactive video and some data applications) and non-real-time (messaging and other data applications).

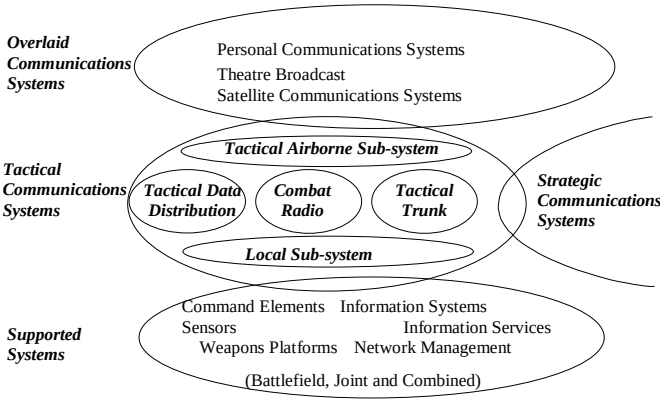

Figure 1. Land communications architecture [1,2].

Arguably the key function of the trunk system is to provide relatively high capacity between major aggregations of staff or command support functions. The trunk system provides a backbone for interconnecting other systems into the system of systems for instance the interconnection of discrete sub-networks of the tactical data distribution system.

TECHNICAL APPROACHES

Figure 2 (from [1] and [2]) describes the “area communications” form of trunk communications currently fielded in larger, conventional armies such as the US and UK. The fundamental concept is of a series of backbone “trunk nodes” laid across the battlefield into which HQ “access nodes” can connect. The trunk nodes are sited for optimum communications and coverage of the area of operations, allowing access nodes to be sited tactically.

Current technology focuses on user-access circuit switches operating in a “system high” security mode. Circuit switches at the trunk nodes also operate at the system high to allow for signalling interchanges with the access nodes. The approach allows individual user connections to be processed at the trunk node to employ optimum routing through the trunk