

CASE STUDY

Improving the Configuration of a Cellular Telecom Network Design

Business Problem: A law enforcement agency needed to install a cellular communication network. The network had to support some 230 calls per hour of varying durations in its first year of operation, and the number of calls was expected to increase annually. The network connected mobile and stationary units to a switch through two hubs. These hubs communicated with each other over five microwave relay stations. Each hub included control computers, scramblers, and modems in parallel arrangements for redundancy.

The key performance criterion was the time it took a call to go through the network. Since the microwave relays were a single point of failure, the system vendor suggested installing a redundant set of relays at an additional cost of \$1 million. The vendor's own reliability analysis indicated that redundancy would reduce relay down-time from 123 hours annually to under a half-hour. The agency wanted to model the entire communication network including the effect of the redundant relays, but this was ruled out because of the expense and time required to create a custom model which would capture the various system redundancies and failure and repair rates.

The unique features of SPAR™, Clockwork Solutions' performance modeling technology, enabled the agency to build a detailed model of the entire communication network in very short order. SPAR™ empowered the modeler to take full account of



- standby component relationships such as uninterruptible power supplies (UPSs);
- parallel units and paths, like the scramblers, control computers, and modems;
- variable load factors such as call duration;
- failure rates and time-to-repair;
- spare parts availability.

The SPAR™ model identified several factors besides microwave relay failure which were judged to contribute to system unavailability. Failure of a relay station accounted for only 14% of performance loss. Power failures accounted for a 23% loss of overall capacity. SPAR™ revealed that the primary, performance-limiting factor was the number of receiving channels which accounted for 63% of unavailability.

Benefits: Based on this analysis, Clockwork's client avoided the costly and inferior investment in redundant microwave relays. Instead, the client redesigned the configuration of the network to include additional receiving channels as well as UPS capability. This had the effect of greatly increasing system performance at negligible cost. Furthermore, due to the expected increase in telecommunications traffic, the client required the use of equipment which allowed for easy expansion of receiving channels in the future as this had been identified as the primary performance-limiting factor.

SPAR™ provided the agency with capabilities it did not previously have. These included:

- analysis of the design of the entire communications network prior to implementation;
- identification of potential sources of performance problems;
- evaluation of alternative design options and selection of appropriate redundancies.

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