

# Transformative Innovations: Unveiling the Potential of Networked LC-MS Systems in Analytical Laboratories

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## ABSTRACT

The evolution of Liquid Chromatography-Mass Spectrometry (LC-MS) instrumentation in analytical laboratories is driven by the need for heightened collaboration and connectivity, all while safeguarding compliance and data integrity. As laboratories strive to elevate their access to and utilization of laboratory data, this article delves into the principles, technologies, and myriad benefits arising from the interconnected nature of networked LC-MS systems within analytical laboratories.

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## INTRODUCTION

### REDEFINING ANALYTICAL CHEMISTRY

LC-MS systems serve as key assets to the analytical laboratory, complementing the laboratory infrastructure and ensuring that the needs of the laboratory are met despite rapidly changing data and information requirements. LC-MS assays provide a robust platform for compound characterization, identification, and quantification across diverse scientific disciplines. Despite their versatility, sensitivity, and proficiency in handling complex samples, the increased application of LC-MS systems brings forth challenges, including high ownership costs, data management complexities, hindered collaboration, and difficulty maintain robust regulatory compliance between siloed systems.

This whitepaper endeavours to explore how networked LC-MS systems can surmount these challenges, aiming to empower analytical laboratories to excel in optimizing data generation and enhancing overall efficiency.

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## OVERVIEW OF NETWORKED LC-MS SYSTEMS

### UNRAVELLING THE ARCHITECTURE

The intricate architecture of networked LC-MS systems plays a pivotal role in fostering a unified analytical environment. From the dynamic interplay between LC and MS instruments to the integration of data systems and software platforms, a thorough examination reveals a framework that encourages real-time communication and concurrent instrument systems use and collaboration.

A waters\_connect™ network deployment for LC-MS systems comprises of an N-tier architecture (figure 1):

1. Presentation Layer: Enables users to access, set up, and view information within the network solution.
2. Acquisition Layer: Facilitates the transfer of data generated by LC-MS systems via the Laboratory Network Device (LND), ensuring enhanced raw data security and data buffering during network downtimes.
3. Application & Database Layer: Centralizes data storage, encapsulating business logic, data access, processing, and reporting, contributing to streamlined instrument interconnectivity.

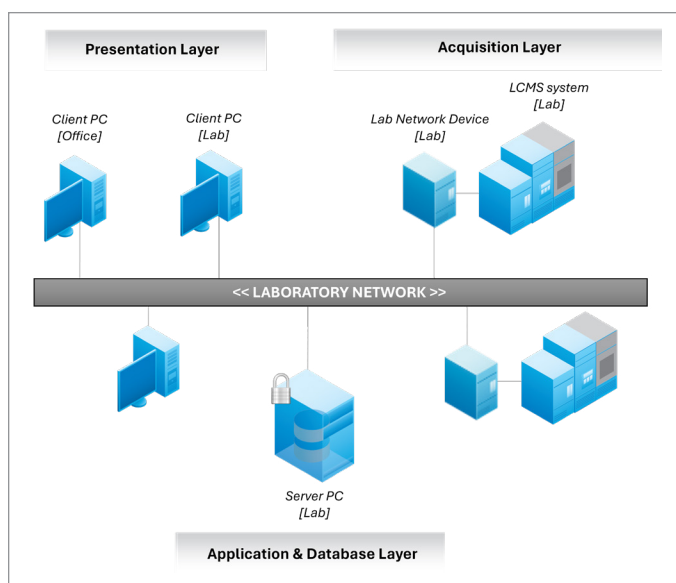


Figure 1. Visual representation of the waters\_connect N-tier network architecture.

## BENEFITS OF NETWORKED LC-MS SYSTEMS

### MAXIMIZING ANALYTICAL EFFICIENCY

Implementation of networked LC-MS systems brings forth numerous advantages, the most prominent among them being increased throughput. Leveraging these solutions transforms analytical efficiency and laboratory productivity by enabling concurrent access and analysis by multiple users. This fosters easier data and method sharing, enhancing collaboration and productivity scaling in response to emerging business opportunities.

Moreover, the paramount importance of data integrity and security is addressed through enhanced IT control, database structure protocols, and restricted access policies. Networked LC-MS systems secure and centralize data management, ensuring consistency in upholding the highest standards of data integrity.

The adoption of networked LC-MS systems not only optimizes analytical workflows but also contributes to cost reduction in system ownership through centralized management of users, roles, and configuration settings, eliminating the overheads associated with maintaining alignment across disparate systems.

### THE BENEFITS OF NETWORKED LC-MS SYSTEMS:

- Improved Security & Compliance
- Centralised data
- Single point of backup
- Corporate IT Infrastructure Integration
- Lower cost to manage & scale-up cost
- Maintain a service plan on one deployment
- Higher lab throughput and productivity

## CASE STUDY

### BIOSPRING EXPANDS EXISTING PORTFOLIO WITH COMPLIANCE-READY, NETWORKED LC-MS SYSTEMS<sup>1</sup>

Since 1997, BioSpring has developed and manufactured oligonucleotides of the highest quality for its clients around the world. Located in Frankfurt, Germany, the contract manufacturing organization's (CMO) 600+ employees provide reliable analytical solutions for commercial therapeutic and late-stage oligonucleotides, as well as preclinical, diagnostic, and R&D applications. Since 2018 the company has charted a rapid expansion plan as demand for its products and services has increased due to the high therapeutic potential of oligonucleotides, technical advances in oligonucleotide synthesis, and more research activity in synthetic biology.



BioSpring is expanding its quality control department with the implementation of networked LC-MS systems.

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BioSpring's market strategy includes expanding the company's facilities and services, such as the extension of the company's quality control (QC) department and the addition of a new laboratory specifically designed for bioanalytical analysis. One phase of these plans included the recent deployment of several LC-MS systems on a waters\_connect Software network. Implementing several networked systems has allowed BioSpring to expand its QC services and better meet the growing demands of oligonucleotide manufacturing. The rapid expansion of the pipeline for oligonucleotide-based therapeutics is only getting faster. As a result, companies like BioSpring are looking to integrate forward-looking strategies, as well as advanced analytical instrumentation, to maintain the emphasis on quality while also meeting the growing demand from clients. That requires oligonucleotide manufacturers and service providers to identify new analytical technology to help develop new products that can be introduced on the market more quickly. In addition to improving and expanding capacity, implementing several networked LC-MS systems enabled BioSpring to move some services previously outsourced back in house. That means more savings in both time and costs for the company, as well as more control over the process.

Like many other manufacturers and analytical service providers, BioSpring are always looking to further improve cGMP and regulatory compliance, as well as product quality, and maintain a state of the art technology standard. Implementing networked LC-MS Systems provided them with a complete audit trail, configurable access controls, and a relational database, which can help companies ensure data integrity, as well as meet 21 CFR part 11 and Annex 11 requirements.

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## CONCLUSION

### SHAPING THE FUTURE OF ANALYTICAL CHEMISTRY

In response to the escalating demands placed upon laboratories to enhance throughput and concurrently reduce costs, an emerging trend in laboratories involves the exploration of solutions that facilitate seamless optimization of operational processes. Laboratories, under the mounting pressure to streamline operations, foster collaboration, and safeguard the integrity of their data, are increasingly turning to innovative solutions. In this context, the integrative capabilities intrinsic to networked LC-MS systems stands out as a comprehensive solution. This sophisticated and interconnected approach not only addresses the multifaceted challenges faced by analytical laboratories, but also ushers in a new era of improved operational efficiency, increased cost-effectiveness, enhanced data integrity, and effective collaboration. The integration of networked LC-MS systems represents a strategic response to the evolving landscape of laboratory requirements, providing a robust framework for navigating the intricate intersection of efficiency, economy, data fidelity, and collaboration.

## References

1. BioSpring Implements Waters Compliance-Ready LC-MS Workflows for Oligonucleotides to Expand Existing Portfolio, <https://www.waters.com/webassets/cms/library/docs/720007453en.pdf>, Waters Corporation, 2022

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