PROJECT SUMMARY

Overview:

Two of the key challenges in the design of dynamic spectrum access (DSA) technology are operation security and efficiency in spectrum management. For many federal or government incumbent users (IUs), its operation data are classified. Secondary users (SUs) operation data may also be commercial secret for its operator. Yet, to realize efficient spectrum access, current DSA designs often needs to reveal IUs and SUs's accurate operation data to untrusted third parties, which exposes sensitive IU and SU data to potentially severe privacy violation. A few of existing works have studied privacy and efficiency in DSA separately. However, no exiting work has thoroughly examined these two key challenges jointly. In essence, how to protect IU and SU operation privacy while still ensuring efficient spectrum allocation is still an open problem.

In this project, we will provide answers to the above key questions. We will study various existing DSA design options and identify what information that are exchanged in these designs can be potential privacy and security threat to IU/SU and seeking efficient schemes to mitigate these threats. We plan to also thoroughly examine the limitations that different privacy-preserving approaches impose on the design of spectrum allocation scheme so that trade-off between spectrum allocation efficiency and privacy/operation security protection can be identified.

Intellectual Merit:

To the best of our knowledge, we are the first to seek thorough understanding of the trade-off between privacy preservation and DSA system efficiency. Our study will exam both distributed and centralized DSA designs, so as to identify and solve their different challenges in joint privacy preserving and efficient spectrum allocation designs. Our research will explore different privacy preservation techniques, such as obfuscation on input data, homomorphic computation over the ciphertext domain of input data, aggregation of exchanged information, etc. Our research will also be based on real spectrum data from actual spectrum observatory.

Broader Impacts:

DSA is one of the critical means for overcoming the severe spectrum shortage problem. However, such systems give rise to many new spectrum assurance and privacy issues. Thus, regulators and potential SU/IU operators will not be willing to adopt such a flexible sharing of the radio spectrum unless these issues are adequately addressed. Research results from this project will provide valuable solutions for addressing such concerns and hence greatly help the development of the entire nation?s broadband networks.

The developed techniques will provide a blueprint on how privacy-preserving mechanisms can be integrated in many other communication systems beyond DSA, including resource allocation in communication system, computation resource allocation, storage resource allocation, task allocation, power allocation, work load allocation, and other type of common resource allocation problems in networking systems.

The project will also tightly integrate research with education. The PIs are committed for supporting underrepresented group in this project.