

Fig. 7. The proposed SCMS framework based on cloud computing.

#### D. ECMS Framework Based on Cloud Computing

Figure 8 shows the proposed ECMS framework based on cloud computing. By analyzing the ECMS framework in Fig. 4, the Mask Management, GDSII Database Management, Yield Management, IP/Library Management, Patent Version Management applications are suitable to be moved from the factory side to the cloud. These applications can be constructed as cloud services to form an engineering chain cloud. Then collaborative companies can communicate and exchange engineering data and documents with one another through the services provided by the engineering chain cloud.

Based on this new ECMS framework, several challenges and issues can be investigated and addressed, including construction of engineering chain platforms based on cloud computing infrastructure, developing large data sharing mechanisms, building users access control schemes, developing secure data transmission schemes, creating collaborative design processes on the cloud, building engineering chain related cloud services.

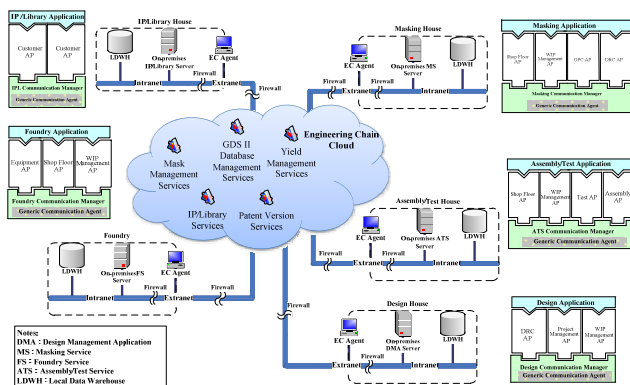


Fig. 8. The proposed ECMS framework based on cloud computing.

#### IV. CONCLUSIONS

In recent years, cloud computing has emerged to be a new trend of information and Internet applications. By leveraging the characteristics and advantages of cloud computing, the current Internet-based e-Manufacturing systems can be transformed to corresponding cloud computing-based e-Manufacturing paradigms. In the paper,

we introduce the potential benefits that can be brought to manufacturing industries by using cloud computing first. Then, the scope of e-Manufacturing and several Internet-based e-Manufacturing systems are reviewed and analyzed. Finally, we propose four new cloud computing-based e-Manufacturing frameworks, namely the MES, EES, SCMS, and EEMS frameworks based on cloud computing. We also highlight the challenges and issues that need to be investigated and addressed in the paradigm transform from Internet to cloud. The results in this paper can be a useful reference for researchers and practitioners who would like to investigate or construct e-Manufacturing systems based on cloud computing.

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