: What is the evolution of decision support and analytics architectures?

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During the past 70 years as new computing technologies have been developed, the computing architectures for decision support and analytics have incorporated or exploited the technologies to deliver new or improved decision support capabilities. A computing architecture refers to the components and sub-components required to deliver or provide an application or software capability. The initial computing architecture was a centralized, standalone computer with simple input/output interfaces and programmer users. This discussion will emphasize changes and characteristics of 4 "architectural" components: hardware, operating system, software, and users.

Power (2008) defines "An architecture for a computerized decision support system documents the plan for deploying the components of the envisioned DSS, or it describes how the components were actually deployed in an implemented decision support application. In general, DSS architecture specifications focus on the dialog/user interface, model base and database components and how they are interconnected." According to the IEEE standard, "architecture is the fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution" (IEEE 1471-2000).

Decision Support Architecture Generation 1.0 In 1951, Whirlwind was the first real-time computer. It was built at MIT by a team led by Jay Forrester for the US Air Defense System. This computer was the first to allow interactive computing, users could interact with it using a keyboard and a cathode-ray tube. In the United Kingdom, J Lyons, a food company, ran the first business application on the Lyons Electronic Office (LEO) computer system. The hardware was anchored in vacuum tubes, the operating systems were elementary, the software was specialized and decision support was included with operational tasks like payroll, and finally users needed some technical expertise. (see https://en.wikipedia.org/wiki/Timeline_of_computing_1950%E2%80%931979)

Decision Support Architecture Generation 2.0 -- Time Sharing involves using multi-programming and multi-tasking to provide a computing resource to many users concurrently. In 1966, Tymshare was founded to sell computer time-sharing services and Raymond described using computer time-sharing for business planning and budgeting. This architecture was used for many tasks including decision support in the 1960s and 70s.

Decision Support Architecture Generation 3.0 -- Sprague (1980) DSS architecture. Sprague and Carlson (1982) defined the components of the DSS technology framework as dialogue

management, database management, model base management, and DSS network architecture. They argued the DSS architecture describes the mechanism and structure for the integration of the dialogue, database and model management components. They identified four architectures: the DSS Network, the DSS Bridge, the DSS Sandwich, and the DSS Tower. The DSS Network has multiple dialogue, modeling and database components that are interconnected and can share data through a component interface. The Bridge has a standard interface with local dialogue and modeling components that link to remote modeling and database components. A Sandwich architecture has a single dialogue and database component, but multiple model components are linked by the architecture. The dialogue and database components are the "bread" and the model components provide the "meat" for the application. Finally, the Tower includes more vertical components or tiers with data extraction tools integrating diverse database components. The rest of the Tower architecture is similar to a Network structure.

Decision Support Architecture Generation 4.0 -- Web-based DSS architecture. Power and Kaparthi (1998) identified six DSS architectures: distributed dialogue, remote dialogue, distributed model, distributed data, remote data and stand-alone. The distributed dialogue is basically a thin-client web architecture with the dialogue presented on the client and with models and data accessed from one or more servers using a network connection. The remote dialog is a more traditional thick-client application with the entire dialogue interface on the client and the model and database components on one or more servers. In the distributed model, the application software on the client expands, and model capabilities are distributed for more efficient processing. The distributed data architecture requires accessing data across the network for processing. With a remote data architecture, some data is downloaded to the client for faster processing. Finally, a stand-alone architecture has the entire DSS application on a stand-alone computer with no provision for network access to server based components."

Decision Support Architecture Generation 5.0 -- Cloud-based DSS architecture

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