GEOGRAPHIC NETWORK

-----New GIS architecture for society -----

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ABSTRACT

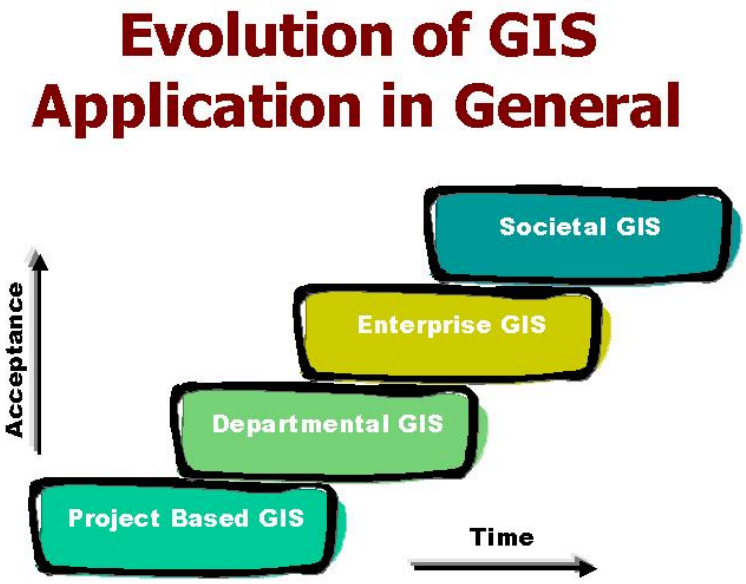
This article introduces a new architecture ---- geographic network, for GIS applications at societal era. GIS progressed from separated projects application, to departments, to multi-departments, now step in societal applications. GIS already provide geographic information by millions installations in many types of divisions, governments and organizations. Now, development of GIS technology leads world to share geographic information on more opened Internet and networks. Geographic Network architecture provides multiparticipant, collaborative and scalable GIS structures based on thousands of distributed GIS installation. It is expected that more data producers, map agencies of different governments, enterprises, communities and society will benefit from geographic network by sharing valuable huge volume of geographic information, covering the global and small communities, to efficiently manage our environment and resources.

PROGRESS OF GIS

Since computer cartography and GIS technology introduced fundamental functionality in more than three decades ago, map data collection and management, map presentation, and map production have dramatically

changed. GIS application level steps forward from individual project stage, to department stage, to enterprise stage, and now steps forward to societal stage.

At the first level of GIS application ------ project level, computer cartography started to provide functions in order to represent map features by suitable computer data structures, to generate and to display maps by computer graphic functions. As result of this stage, a single map can be represented and stored into computer GIS system and display. People can see a map on screen. At this stage, separated projects and its owners isolate geographic information.

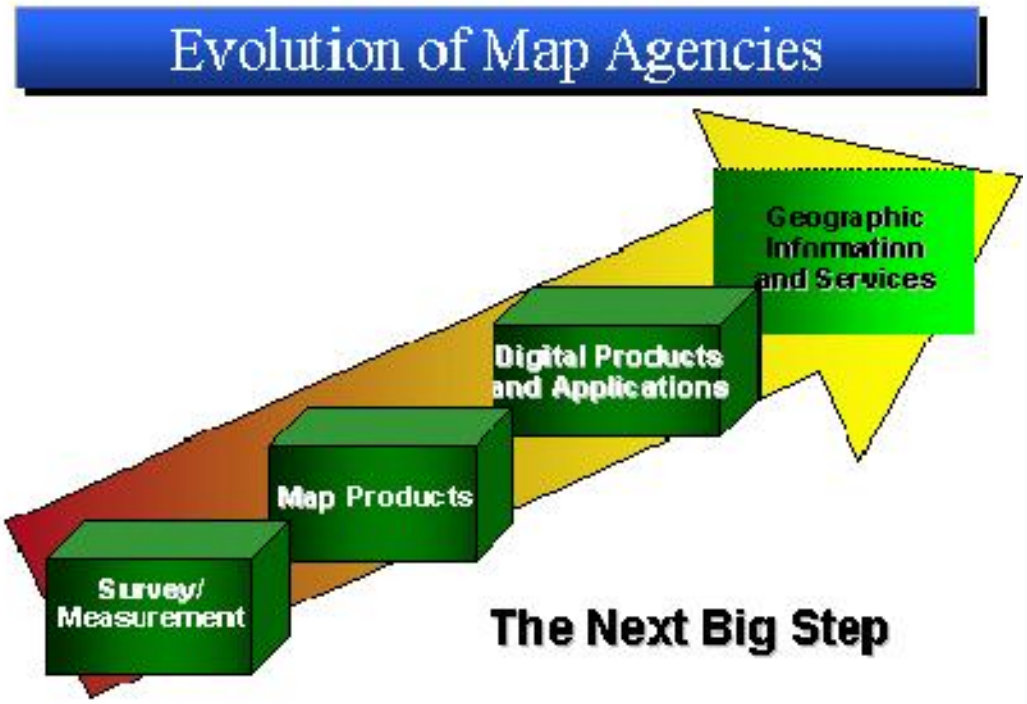


At the second level of GIS application ------ departmental level, GIS performs important map information storage and upgrade. One departmental computer database stored relating GIS information, including graphics and distributions. This database keeps up-to-dated by the department to currency for GIS to generate fresh map in any time. Output maps, either on screen or on paper, are only a view at one moment of the GIS database that is keeping changed. At this stage, geographic information is upgraded and shared inside the department.

At the third level of GIS application ----- enterprise level, multi-departments share a common GIS database by computer network. In earlier stage network can be LAN, and now it can be Intranet or Internet. Maps generated from different departments can be seen as different views of the shared GIS database at different moment from different analysis purpose. Any map generated from the enterprise benefit from its shared GIS database to reflect all integrated and upgraded geographic information. Since a shared GIS database integrates geographic information from multi departments, GIS technology is requested to have capability to handle consequent difficulties caused by multi users, e.g. long term transaction problem, that contents conflict caused by multi-transactions of multi-users. These functions and procedures perform better work for traditional map edition, data collection, transaction and integration. For various sizes of enterprises, GIS technology support client/server structure that can be scaled to only one level or multi-levels, from very simple system to complex system.

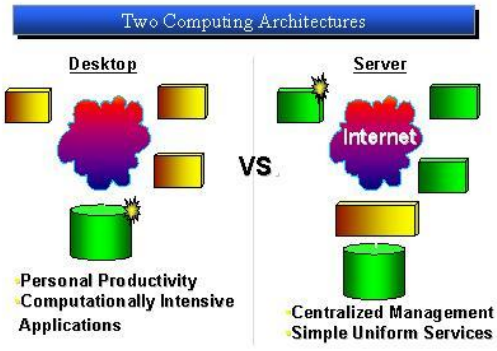
Rapidly growing up Internet helps GIS technology rushed into the fourth level ------ Societal application level. At this level, GIS becomes a general public tool. Its users are professionals and non-professionals; its service targets to multi-disciplines; it provides more sophisticate decision-making analysis procedures that depend on various information sources. Traditional map providers face public request to access geographic information and professional knowledge of many disciplines efficiently, instead of just provide ready maps. These experts and professionals need to find, to collect, to integrate and to use geographic information from multi sources generated from multi-region and multi-discipline. Once more, it is necessary to find a new architecture of GIS to satisfy requirements from societal GIS applications.

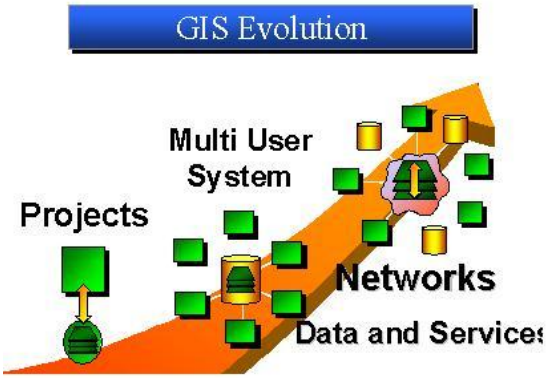
This figure shows GIS progress in last three decades for a map agency, reflecting by its functionality and applications. Network backbone GIS from department to enterprise. It is quite clearly that this type of agencies plays more advance roles and services for the society, since they adopted GIS technology.



GEOGRAPHIC NETWORK ARCHITECTURE

"Geographic information systems are evolving to support a new, network-based architecture. This architecture is for multi-participant, collaborative and will allow organizations to openly share and directly use GIS information from distributed sources at same time." (Jack Dangermond, 2001).





Geographic Network is a good example of this architecture. This architecture is based on providing and consuming geographic information services through open, Internet protocols.

The architecture works with any scale of implementation and in any size of organization. Each organization can first install their individual GIS facility in their departments, then for the whole enterprise, and finally link their own GIS servers to Internet. It provides a whole new way for GIS organizations to share their geographic knowledge and work together.

Current information technology, including computer hardware, software, networks and internet, already initiate and will better support the new GIS architecture for widespread applications in society. Here are brief key involving technologies current available to support GIS Geography Network in a societal level.

---- GIS server can provide full spectrum of application functionality to support society applications;

---- Modular components of GIS technology allow scalable GIS servers set up separately, and expendable at different time frame;

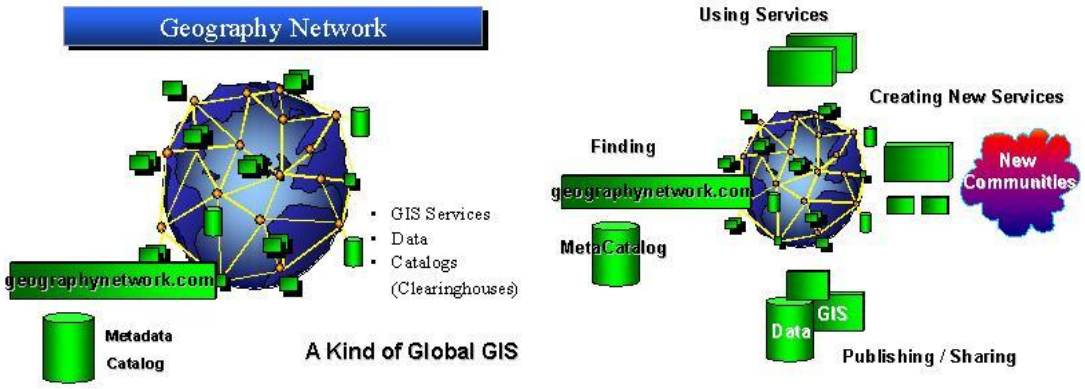
---- RDBMS technology can fully manage very large GIS databases with any users;

---- Array of network (internet) connection provide solutions for complete distributing computation environment for GIS clients, including on desktops, browsers, mobile devices and embedded solutions;

---- More smart metadata catalog available on network;

---- More IT standard available for software, spatial data standard, and hardware platforms;

These technology capabilities build foundations for GIS working from various scales of enterprise, communities, and society.



GIS for society will provide GIS professionals with an open environment for sharing and interconnecting their information. The current running Geography Network is a good example of this architecture at global scale. However, same architecture can also be used at many scales inside and/or among organizations.

Second, the geographic information server architecture allows organizations to "publish" or serve GIS functions to general public communities. An example is the server "MapMachine" of the National Geographic Society. It can be accessed worldwide and supports generation of more than 500,000 customized GIS-based maps daily. Many governments of federal, state, county and cities also have servers to provide GIS services to public.

Third, wireless computing capability will be included into distributed computational network. Geographic information and rich GIS functionality will be easier to be implemented in the field and mobile environment. This trend opens a significant potential of known as "location-based services" for all communities, such as tracking any objects, routing, locating services, and e-yellow pages.

Forth, the introduction of feature-oriented geo-data structure provides a foundation for easier communication among multi GIS servers. Metadata helps data sharing among various disciplines.

MAP ORGANIZATION ON CHANGES

Only technology is rarely powerful enough to change working style of an organization. It relates with data sharing policy, working flows, and people's training level. These are not easy tasks. However, we already experience progresses of GIS applications from individual object level forwarded to departmental level, and then march to enterprise level. We also have successful installations such as UNEP and State of Texas as good pioneers. We have reasons to expect GIS applications widespread in society will be in near future.

CONCLUSION

Technology development has begun to build road for GIS forward to societal stage. Geography Network architecture is one potential for all different scales of organizations to create their GIS server and then connect others for benefiting from distributing GIS installations. Geographic information can be shared and used more efficiently, and GIS can play more analysis based on rich information for wide range of applications.

REFERENCES

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<2> Zitan Chen, 2001, A Way in GIS, Science Press, Beijing & New York