WHITE PAPER – NTCIP IS THE KEY TO SIMPLIFING THE PLANNING PROCESS FOR THE DEPLOYMENT OF INTELLIGENT TRANSPORTATION SYSTEMS

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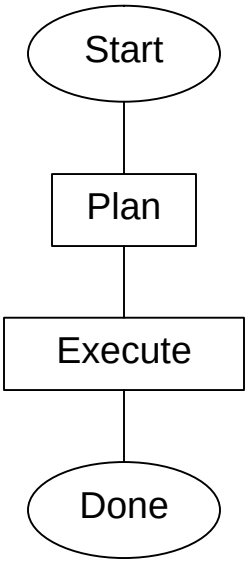
February, 2007.

The Implementation Process for ITS Systems

The deployment of the ITS (Intelligent Transportation Systems) is often viewed by stake holders as an "exact science". All you need to do is to have:

- a comprehensive planning process to identify the user needs
- a comprehensive design process to reduce the user needs to project plans
- a comprehensive implementation process to execute the project plans
- a comprehensive verification and validation process to verify that what is being implemented complies with the user needs.

Then you're done…



The problem with this approach is that it ignores some of the practical difficulties that go along with implementing ITS Systems, including:

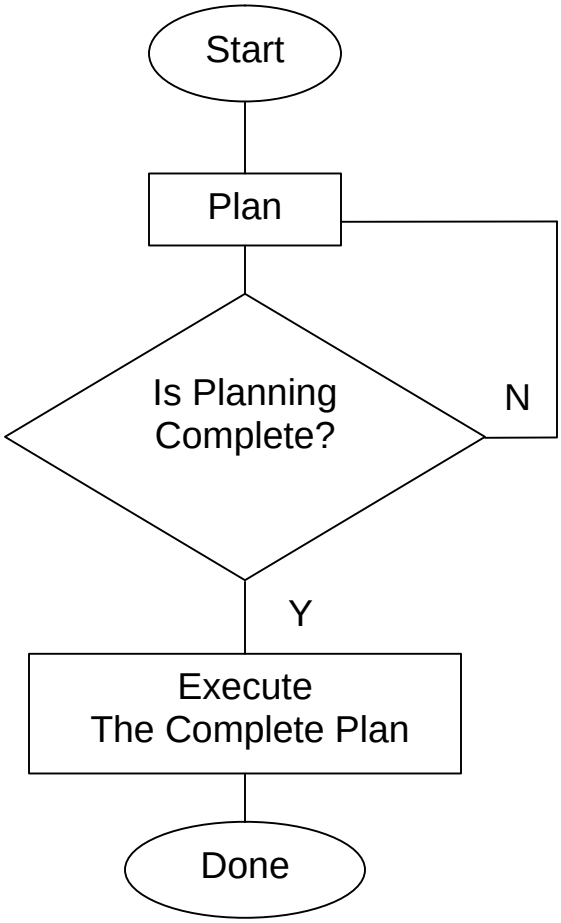
1) It is often difficult or impossible to identify a comprehensive user needs "at a point in time" that will endure for the several years it will take to implement an ITS system. User needs are often vague and change as their experience with the ITS implantation grows.
2) The political process, and staff turnover, cause change to requirements with the passage of time.
3) Technology changes continually. During the multi-year process of implementing ITS, it is quite likely that there will be technology changes that can cause changes in the project plans.
4) Budget constraints often dictate that the project needs to be implemented in phases.
5) Operational capacity often requires that ITS be deployed in phases.

This approach to the deployment of ITS systems can lead to the expectations of stakeholders not being met and the assessment that the ITS technologies and system does not really "work".

The Planning Trap

It is the best intentions of everyone involved in planning an ITS project that it is delivered on time; on budget and it meets the expectations of all the stakeholders

involved. This goes to the core of the planning process, and many text books and very competent professionals spend enormous resources in the pursuit of "perfect planning".



Planning is often varied in some form similar to the diagram on the left. However, at each design review to determine if the planning is "complete", the answer invariably comes back "no". This can be due to one or more of the following:

- Need a complete plan, plan some more…
- Technology has changed. Incorporate new technology in the plan…
- Not quite done, plan some more, with more detail…
- The program manager has changed. Review plan to verify user needs…
- Plan too big to execute. Split up into smaller plans…
- Plan too fragmented to execute. Combine fragments into bigger pieces…

In some examples, this planning process has taken several years to complete. Implementation is delayed while all this planning is going on, which can further delay the completion of the planning. This can end up in a "Catch 22" situation, of never being able to successfully complete the planning and implementation process, due to being stuck in a relentless cycle of planning and analysis.

The Integration Trap

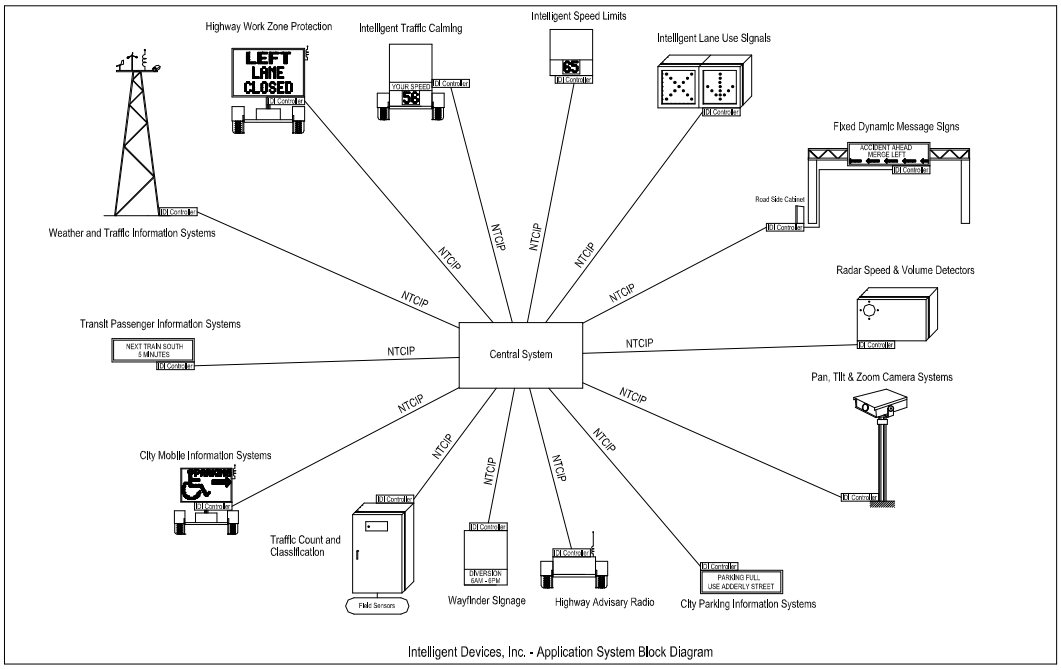
After completing a planning process, the project moves over to implementation. Often, there are multiple sub-systems employed on these projects, including

- Variable Message Signs of various types and sizes
- Traffic Sensors of different types
- Lane Control Signs, Ramp Meters and other auxiliary freeway technologies.
- Bus and Transit interfaces.
- Signal Priority and Preemption

Often future needs are expressed in the planning process. This can include technologies like:

- Automatic incident detection.
- Incident Prediction based on traffic patterns, weather forecasts, observed weather.
- Travel Time Prediction, for display to travelers.
- Vehicle location, including Emergency Responders, probe vehicles, computer aided dispatch.
- Emergency evacuation

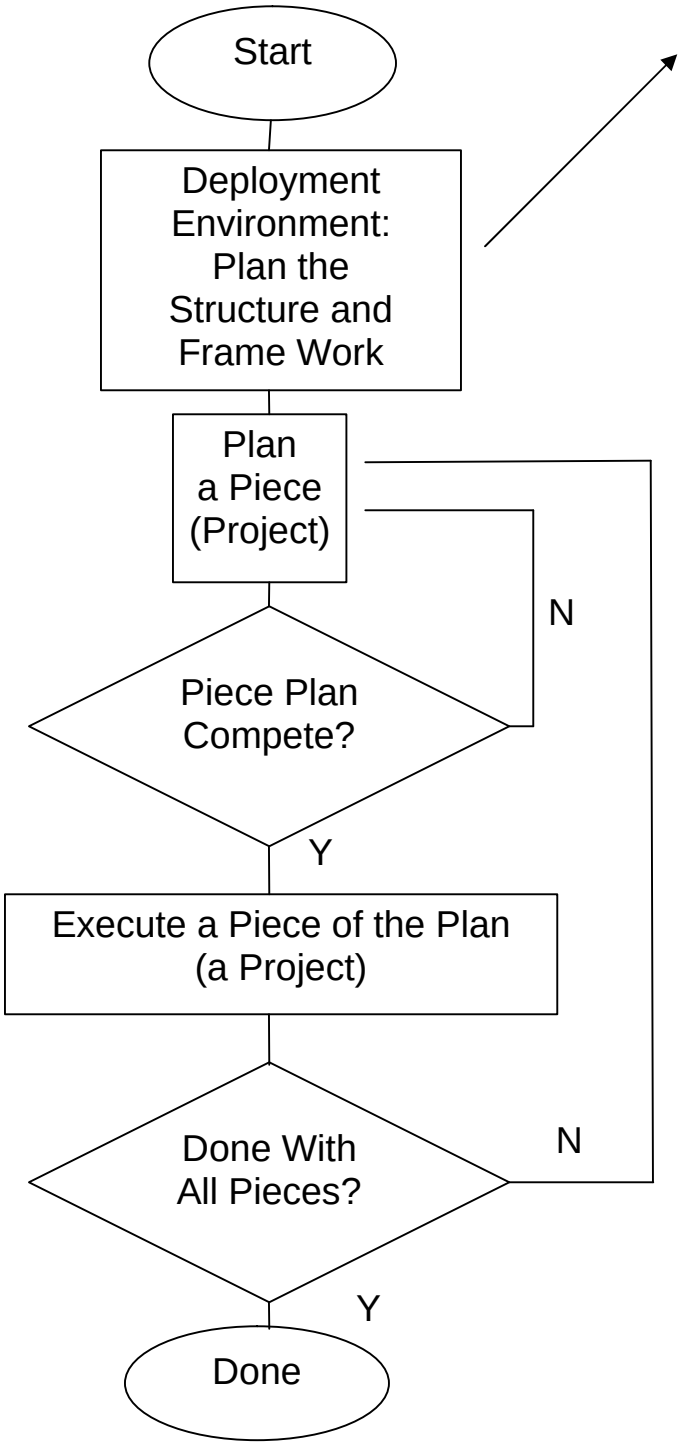
The point of all this is that the integration process can be awash with a combination of systems. These can range from “must have” (like a communication sub system), to a series of “nice to have” features which could sensibly be thought through later in the planning process. However, these future sub-systems are often included up front as there is a fear that it will be impossible to integrate these items later, if the requirements are not established up front in the planning process.



A common approach is to employ a “systems integrator” to deal with all of these issues. Often this involves purchasing the Central System software package sold by the system integrator, who will then proceed to adapt, modify and re-code parts and pieces to try to provide a system that meets the requirement. Often this proves to be more difficult than it looks, and delays, cost over-runs and unreliable performance of the system can result.

The Solution – How NTCIP Can Contribute

The solution to this problem is that the planning process should focus on creating a Deployment Environment for ITS which enables the planning process, and the resulting deployment process, to be carried out in a manageable, phased way.



Planning for the Deployment Environment should include planning the following aspects:

- ITS Architecture
- ITS Standards
  - **NTCIP**
  - Physical Device Standards
- Conformance Testing
- Link Funding to Adoption and Conformance with Standards
- Staffing Levels
- Maintainability
- Stakeholder Expectations
- Program Goals, Visions

The important concept to grasp here is that effectively planning the Deployment Environment, at the start of an ITS implementation process drastically shortens the deployment cycle; reduces risk, and increases the probability that the various stakeholders' expectations will be met.

This is where the early adoption of NTCIP as the base standard for the implementation of an ITS deployment makes sense.

NTCIP (the National Transportation Communication for ITS Protocol) is much more than just a set of standards for communication.

NTCIP provides the following feature set to aid the planning process:

1) A consistent communication environment.
2) A consistent method of testing devise, software and communications
3) A consistent set of functionality for many different device types.
4) A consistent interface for the Central System eases deployment.
5) A consistent way of extending functionality requirements to new device types
6) Competitive deployment is assured.
7) Life-cycle maintainability is assured.

Each of these feature sets, and how they can simplify the deployment planning process, is described further below:

1) Communications: The NTCIP standards describe electronic communication over a wide variety of communication media that have application over most practical communication infrastructures, including serial, dial up, network and wireless. This means that a consistent way of dealing with communications will be assured, irrespective of the communication media. This has immediate benefit in the planning process, as provided the communication structure is designed to accommodate NTCIP. Then this will work correctly for all sorts of different devices. The System Planner does not need to link specific device communications requirements into the design, as all devices will use NTCIP communications.

2) Testing: Testing methods are consistent across all NTCIP devices. There are a number of test tools, test procedures and test processes that have been developed for NTCIP testing. The big advantage that this has for System Planners is that each sub system can be independently deployed, and fully tested at the communication interface against the standard. You can confidently deploy, for example, a small number of signs from one manufacturer, and conduct NTCIP testing at the communications interface. Then, provided you conduct that same test when subsequent signs are deployed from a different manufacturer, you can have a high level of confidence that the both sets of signs will work in the same way. For planning purposes, the deployment of signs can be split into logical phases, and these deployments can confidently occur without linkage to the communication or Central System deployment. There are no uncertainties to resolve during system integration if proper NTCIP testing on sub-systems is done.

3) Functionality: The NTCIP standards describe functionality in terms of “resultant observable behavior” that results from communication activity. For example, NTCIP describes in detail the communication to cause a message to be displayed on a sign, or a traffic controller to change a timing plan, or a camera to pan or tilt, and so on. The benefit of this

approach is that the important functionality and behavior of ITS devices is defined up front, in a consistent manner. This reduces the procurement and project planning substantially, as the devices can then be deployed on a phased basis, with the assurance that devices deployed later in the process will work functionally in the same way as devices deployed earlier in the program.

4) Central System: Building, configuring and deploying a Central Computer system is far simpler if all the field devices are NTCIP conformant. The internal system architectures of this kind of Central System is far simpler when based around NTCIP, rather that a disparate mix of proprietary protocols. Requiring a NTCIP Central System also simplifies the planning process, as the Central system can be procured independent of the field devices. For systems based on proprietary protocol, the array of protocols for the field devices needs to be known before a Central System can be procured.

5) Extensibility: A number of Device Types are already covered by the NTCIP Standards. However, there is no limit to the device types and special functionality that can be accommodated in the NTCIP process. This is a quite straightforward, where extended functionality can be obtained in a manner quite consistent with the NTCIP Standards. This aids the planning process, as you do not have to have every detail defined of a new system, in order to start deployment. Features and Device Types can be added on a piece-by-piece basis, with the confidence that these new features, functions and devices will work quite consistently with the other devices already deployed.

6) Competitive Deployment: There are a number of competitive companies active in the deployment of NTCIP devices, all over the world. This means that competitive procurement can be assured for a wide range of ITS devices, systems and services. Using proprietary protocols and systems, the opposite was true. Only the first phase of a project could be competitive, as all subsequent phases would the favor the original supplier. Subsequent competitive procurement under proprietary procurement was often impossible.

7) Life Cycle Maintainability: In a well designed NTCIP based system, each of the sub-systems interfaces to the rest of the system at a measurable and testable interface. This means that if support from Vendor A is no longer available, the products from Vendor B can be used in the place of Vendor A’s products, with minimum effect on overall system availability. This reduces the risk during the planning process, of how to assure future system maintainability when the devices, functions and communication protocols are proprietary.

Conclusion

There is a compelling argument that the early adoption of the NTCIP Standards, during the ITS planning process, as a key part of the Deployment Framework, results in ITS systems with a reduced time to market, better performance and lower cost. The NTCIP standards have now been deployed in thousands of systems world wide, and as the vendors providing NTCIP products, software and services have matured over the last several years, these systems have a track record of interoperability between vendors, competitive procurement, and reliable and effective operation.

Recommendations

- Confirm the adoption of the NTCIP suite of standards as a key element in the Deployment Environment Plan for Intelligent Transportation Systems.
- Link the funding of ITS projects to the test and conformance of the Devices, Software and System to NTCIP standards.