

Fundamentals of DDC



Defining/Planning DDC Systems



Presented by:
J. Jay Santos, P.E.

*6760 Alexander Bell Drive, Suite 200
Columbia, MD 21046
(410) 290-0900
jays@facilitydynamics.com*

Defining Your System



m System Architecture

q What is the size of the requirement?

- | Large complex of sophisticated buildings**
- | University Campus**
- | Geographically Spread Out, but Networked**
- | Large single building plant**
- | Single building but complex**
- | Single building but very basic**

q Is there a requirement for remote communications?

- | Distributed sites**
- | 24 hour monitoring by operator**
- | Modem based communication (Legacy)**
- | Intranet based communication**
- | Internet based communication**

Defining Your System



m System Architecture

q What is already installed?

- | Integration requirements**
- | Is integrating to existing part of future projects (If so, to what degree?)**

q What are the growth plans?

- | Building DDC systems incrementally**
- | No growth anticipated**

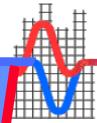
q Is there a master plan?

- | For incremental systems, the lack of a master plan could cause significant extra costs during add on phases**

q What are the priorities?

- | Energy**
- | Maintenance**
- | Reliability**
- | Manpower**
- | Usually, all of the above**

Defining Your System



m **Controllers**

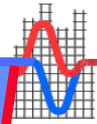
q **What type of systems are to be controlled?**

- | **All terminal equipment**
- | **Built up systems**
- | **Central plants**

q **What are the requirements for each system?**

- | **Accuracy**
- | **Complexity of logic**
- | **Strategy**
 - u **Application specific controllers**
 - u **Customized programming**
- | **Data collection requirements**
 - u **Maintenance**
 - u **Energy**
 - u **Fault Detection & Diagnostics (FDD)**

Defining Your System



m **Interfaces**

q **Operator interfaces (Desktops, Notebooks, Handhelds, Local)**

- | **Who needs them?**
- | **For what purpose?**
- | **Where can they interface?**

q **Equipment interfaces**

- | **Third party equipment?**
- | **Does an open protocol enhance the ability of the controls vendor to deliver control of third party equipment?**
- | **With respect to open protocol, are you sure?**

q **EMS interfaces**

- | **Does information have to be shared between existing EMS and new EMS systems?**
- | **If so, what information must flow back and forth?**
- | **If so, what functions must execute over gateways?**
- | **Does Open Protocol add any capability?**

Defining Your System



m **Integration**

- | **Fire and smoke control?**
- | **Access control?**
- | **Security systems?**
- | **Maintenance management systems?**
- | **Can Open Protocol play a role here?**

m **Backward compatibility?**

- | **For existing systems, will the new DDC talk to the old stuff?**
- | **Do you care?**

Defining Your System



m **Personnel and Training**

q **The Project Manager for acquisition (contracting)**

- | **Who are they?**
- | **What is their knowledge of controls, DDC, HVAC....Do they know what they are buying. Consider comparisons to IT/Computer equipment and software.**
- | **Do they have outside consultant help? Who?**

q **Who will program the system?**

q **Who will make changes in programming?**

- | **Type of programming may be important for ownership**

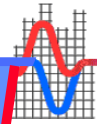
q **How independent does the institution wish to be?**

- | **Type of programming may again be important**

q **How sophisticated will the use of the system be?**

- | **Basic operation**
- | **Optimization**
- | **Reports**

Defining Your System



m Personnel and Training

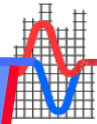
- q What are the basic skills of the people inheriting the system?**
 - | Mechanical systems and controls**
 - | Math, Basic Electrical**
 - | Computers**
 - | IT, networking**
- q Does the organization strongly support training?**
 - | Locally?**
 - | With travel requirements?**
- q Review the corporate training program**
 - | What comes for free**
 - | What programs are required to achieve the objectives pertaining to the anticipated capability with the system?**

Defining Your System



- m Fly before you buy for larger systems**
 - q Visit installed sites and talk to customers.**
 - q Have the vendor set up a demo unit and:**
 - | Walk through the set up and configuration of a small system to include two PCs (one with a hardware environment below it and one connected via TCP/IP), two programmable controllers, one application specific controller and necessary interfaces to the PC.**
 - | Load software on your computers and make it talk to the Demo unit.**
 - | Add and configure a point.**
 - | Teach you how to program a basic system such as a VAV AHU communicating with a VAV terminal.**
 - | Show you how to set up data trending**
 - | Teach you how to create a graphic interface page with dynamic data imbedded on the page.**
 - | Teach you how to set up a basic energy report**

Defining Your System



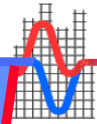
- m **If BACNET or LonTalk are represented as providing the ability of products from different vendors to communicate with each other a demonstration is mandatory**
 - q **Review all the software tools required to set up the demo from scratch.**
- m **If any other protocol is to be used to move data from one system to the other a demonstration is mandatory**
 - q **Set up the two systems on different PCs, connect them**
 - q **Set up the data transfer that you wish to see**
 - q **Does it work?**

Defining Your System



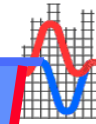
- m **Is there a set of standards for the operation and control of your system?**
 - q **If so, can they be clearly stated?**
 - l **Standard sequences? Logic diagrams?**
 - l **Points Lists? Point Naming Convention?**
 - q **If not, what flexibility do you need for the future development of such standards?**
- m **Do you have severe procurement restrictions?**
 - q **Low cost prevails**
 - q **Technical merit prevails**
- m **What service response will you need?**

Defining Your System



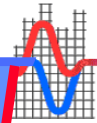
- **Good people will prevail over good DDC systems**
 - **The very best product with a poorly trained execution team will lead to failure and frustration.**
 - **Highly trained project team can do well with basic equipment.**
 - **Do you have any concept on how you will evaluate the vendor's capability and reputation?**

Acquisition Issues



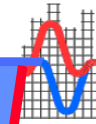
- **Fundamental Choice (Single Vendor or not?)**
 - **Does this matter for a particular project**
- **“Sole Source”**
 - **Perfect World – Single Source with Price Control**
 - **Difficult to achieve**
 - **Need a “Plan B”**
- **“Multi-Vendor”**
 - **How do you limit?**
 - **How do you judge which ones?**
 - **Interoperability?**

Acquisition Strategies



- **“Sole Source”**
 - **Whole site versus partial site**
 - **Most owners are adding DDC systems incrementally**
 - **Unit pricing a must or “Plan B”**
 - **Advantages**
 - **Single manufacturer (still may have to deal with compatibility)**
 - **Training/Documentation learning curve easier**
 - **Disadvantages**
 - **Potential for lack of competition**
 - **“Stuck”**
 - **Sometimes taken for granted**

Alternate Procurement Strategies (Sole Source)



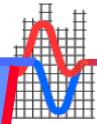
- **Multiple Sources for same product (some vendors, some locations)**
- **Unit pricing for hardware**
- **Unit pricing for engineering**
 - Hourly rate (doesn't help much)
 - Per typical system
- **Engineer software directly (in-house)**
- **Find alternate source to engineer**
- **Compete vendor vs. alternates**
- **Specify standard pieces of system, hardware from unit pricing and only sole source programming, set up**
- **Standardize Systems/Specifications**
 - **Unit Price Systems**



Multi-Vendor

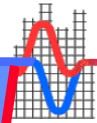
- m **Pre-select (pre-qualify) systems**
- m **Compete two or three vendors**
- m **Advantages**
 - q **Competition**
 - q **Second source should one not perform**
- m **Disadvantages**
 - q **Still have challenges with expansions to buildings**
 - q **Multiple systems to use and learn**
 - q **Training and documentation becomes even more important**

Multi-Vendor Front End



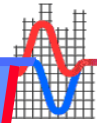
- **Allows multiple systems to be controlled and operated from the same “overlay”**
- **Sounds good - but**
 - **New sole source**
 - **Vendors may not continue to participate**
 - **Updated software by vendors represent a “moving target”**
 - **Still must does not alleviate need for learning proprietary systems**

Open Protocol



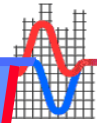
- **“Enterprise” Solutions**
 - **Overlay software/operating system to common protocol beneath**
 - **Echelon or BacNet**
 - **Drivers for legacy systems**
 - **Systems Integrators**
 - **Brick & Mortar of controls become commodity items**
 - **New sole source – but smaller piece of the pie**
 - **How much is displayed “operable” from front-end?**
 - **Parameter level details?**
 - **Currently, still need to know proprietary programming software for underlying hardware**

Open Protocol (1996 slide)



- **BacNet or Echelon**
- **Allows sharing of information by different vendors agreeing on a common protocol**
- **Industry is reacting and final “lay of the land” is still up in the air**
- **New learning curve**
- **Most sites are interested for the purposes of price control and competition**
- **Still will require you to learn different systems**
- **Gain price control another way if possible and plan for inevitability of open protocol**

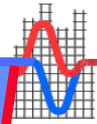
Important Considerations



m **Keys to Success**

- q **Engineering**
- q **Commissioning**
- q **Documentation**
- q **Training**

Keys to Success



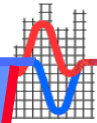
m Engineering

- q Design Engineer must give clear direction (prescriptive)**
- q For vendor, can be 40-50% of system cost**
- q Evaluate application engineering capability of vendor (more important than the hardware)**

m Documentation

- q Contradictory specifications**
- q Performance specifications can be vague**
- q Detailed control logic diagrams**
 - | Design phase**
 - | Submittals**
- q Useful, accurate shop drawings**

Keys to Success



m **Training**

- q **Generic DDC/controls training**
- q **Consider pneumatics course for operators**
- q **Manufacturer specific**
- q **Dedicate individuals in organization to develop**
- q **Create/Allow technical track for advancement**

m **Commissioning**

- q **Controls commissioning extremely important**
- q **Demonstrate/Simulate/Test control strategies off-line first**
- q **Insures engineering, documentation, and training**
- q **System commissioning**