

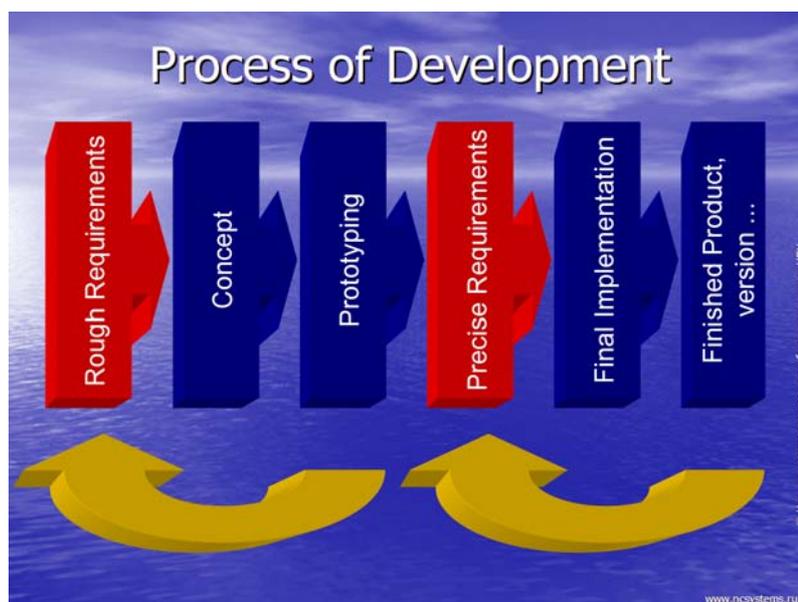
This Part of the Talk will cover the Theoretical Aspects of Software Development

Topics:

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 - *University and Institute Structures*
 - *Tutorial Process and Laboratories*
- Architecture and Control Tasks of the WinPCNC System
 - *Open Architecture*
 - *Terminal Task*
- **Theoretical Aspects of Software Development**
 - *Development Process and Key Technologies*
 - *Component Architecture*
 - *XML DOM-Technology*
 - *STEP-NC Implementation*

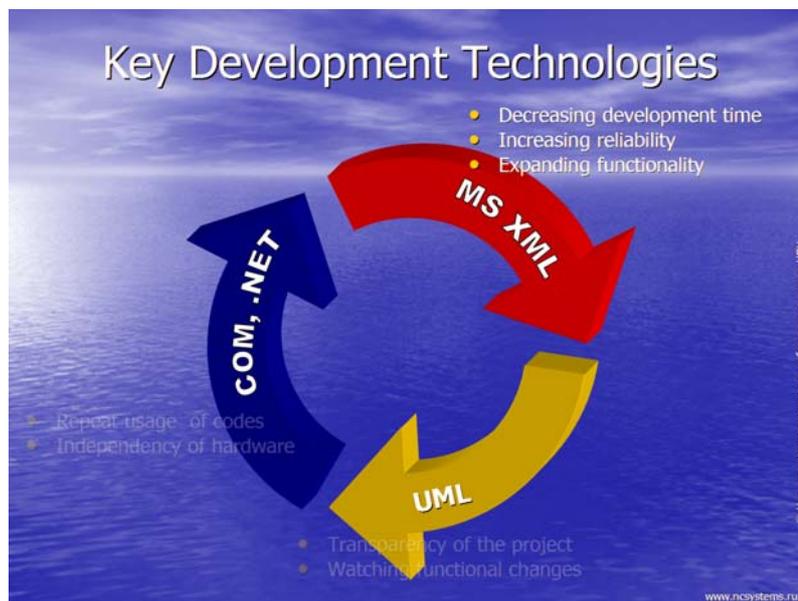
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About 80 to 85 % of modern CNC development is a software implementation. I would like to present to you the basic ideas implemented in our R&D laboratory for the past 12 years.



Our process of development consists of several steps. At the beginning we obtain rough requirements for creating the concept. Next, base on the concept we create the prototype. After that we obtain precise requirements for final implementation and

delivering the release version. Usually, we repeat some of the steps few times before final version is generated.



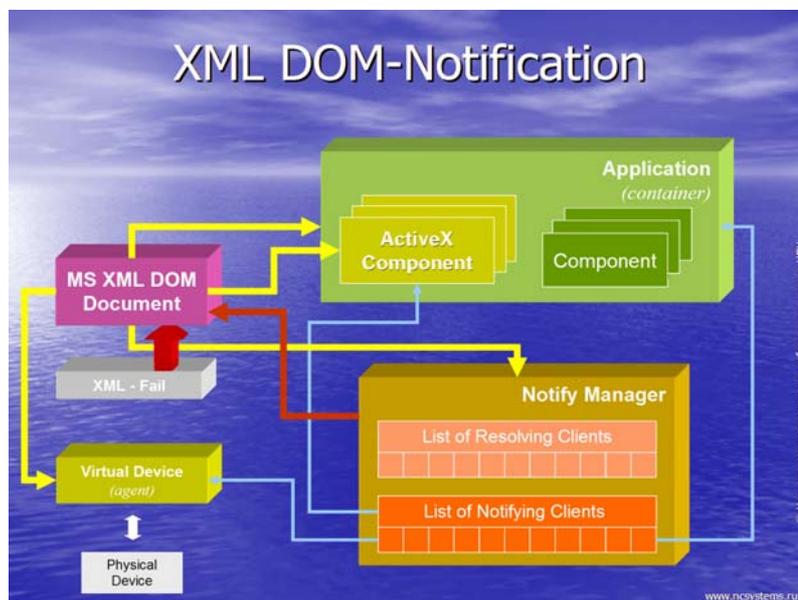
Since typical project involves several software developers we use UML as a tool to create software. This approach makes it very simple to add any changes to the program as well as monitor evolution of the software development.

COM-approach and NET technology allow reuse of codes and independence from hardware. Although the special scheme architecture was used, that will be presented later.

MS XML and Internet technologies allow us to reduce the developmental time and expand the functionality and increase the reliability of the process.



The speed of MS XML parser allows us to apply it for building the internal structure of control system application. This slide is illustrating the mechanism of implementation of the internal application database base with the help of MS XML DOM document. The question is: how to manage the access of different components to the same data?



The problem is that consortium C3W has provided the notification change of the data only in specification of DOM level 3, but commercial development today implements only the DOM level 1 and partly the DOM level 2. To solve such problem we develop our own mechanism called "Notify Manager".

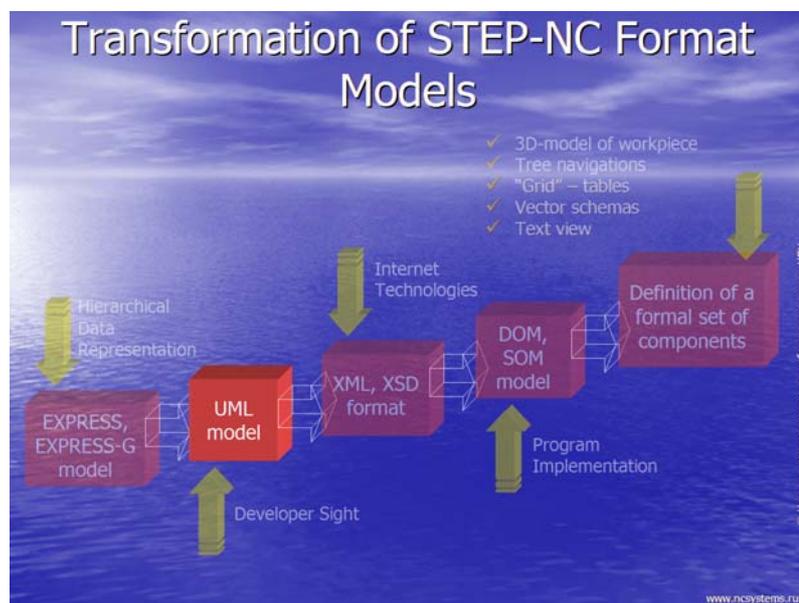
The idea is that data reading access have all components, but writing is done through Notify Manager, if permission is obtained. In this case the subscribed clients obtain a notification.

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Many machinetoolbuilders don't accept the standard STEP-NC because of its complexity. In our opinion the problem is in the manner of introduction of STEP-NC. We offer an original way of its introduction. The key is to use a consecutive transformation of data models.



The **EXPRESS-model** of the data format STEP-NC has appeared historically and gives us hierarchical data presentation. This model is understandable only for a few Product Modeling experts.

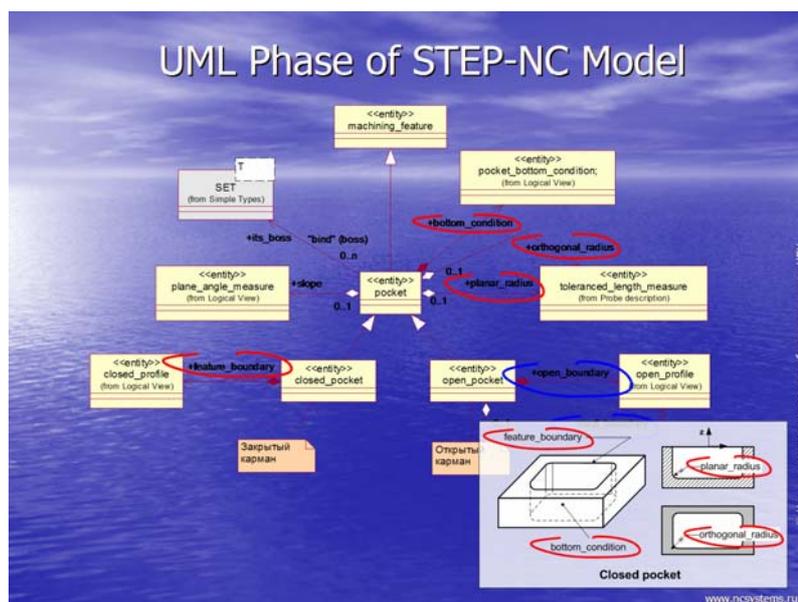
Software developers require **UML-model** of STEP-NC for developing editors, verifiers and other program tools.

Representation as an electronic document with help of XML and XSD files allows to involve the power of Internet - technologies.

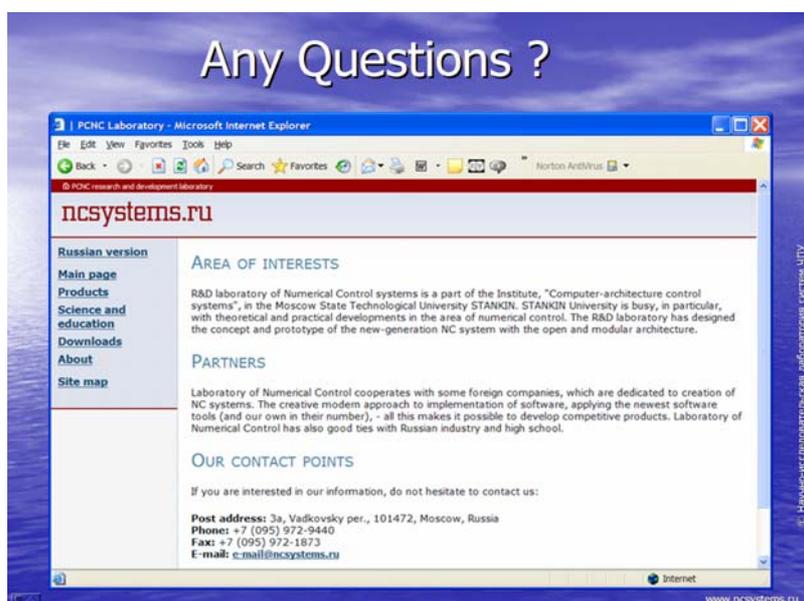
Commercial parsers use this format for building of DOM-SOM model, which defines the program implementation of system.

On the last phase we define a set of necessary components for visual representation of STEP-NC on the screen.

Let's look at the example of UML-model.



This slide illustrates a fragment of UML-model as the class diagram of the open and closed pocket feature. Corresponding colors show the physical prototype of objects.



You can find additional information on our web site.

Thank you for your attention.

Are there any questions?