

Microsoft® Research

# Faculty Summit 2010

## Making a Open Ecosystem

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# Microsoft Open Protocols

Microsoft Open Protocols - Windows Internet Explorer

http://www.microsoft.com/protocols/

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United States Change | All Microsoft S

Interoperability Standards **Open Protocols**

Protocol Documentation Patent Rights Resources

Microsoft Open Protocols

MSDN Resources

- Open Specifications Developer Center
- Open Specifications Protocol Information
- Open Specifications Community Forums

News | Microsoft partners up for open-source Azure, Silverlight tools

**To foster innovation and interoperability,** Microsoft makes available technical specifications for protocols used to communicate with a number of its most popular products, including various versions of Windows and Windows Server, Microsoft SQL Server, Microsoft Office, Microsoft Exchange Server, and Microsoft Office SharePoint Server.

**FEATURED ARTICLES**

**Microsoft working with Xandros responding to feedback from IEC Council member NATO**

Learn more about managing multiple heterogeneous systems across a large distributed network environment from a single point of access and the need to aggregate status information and alerts to

News Highlights | Blog Highlights

**October 29, 2009**  
Eclipse Revisited - this time Windows 7

**October 28, 2009**

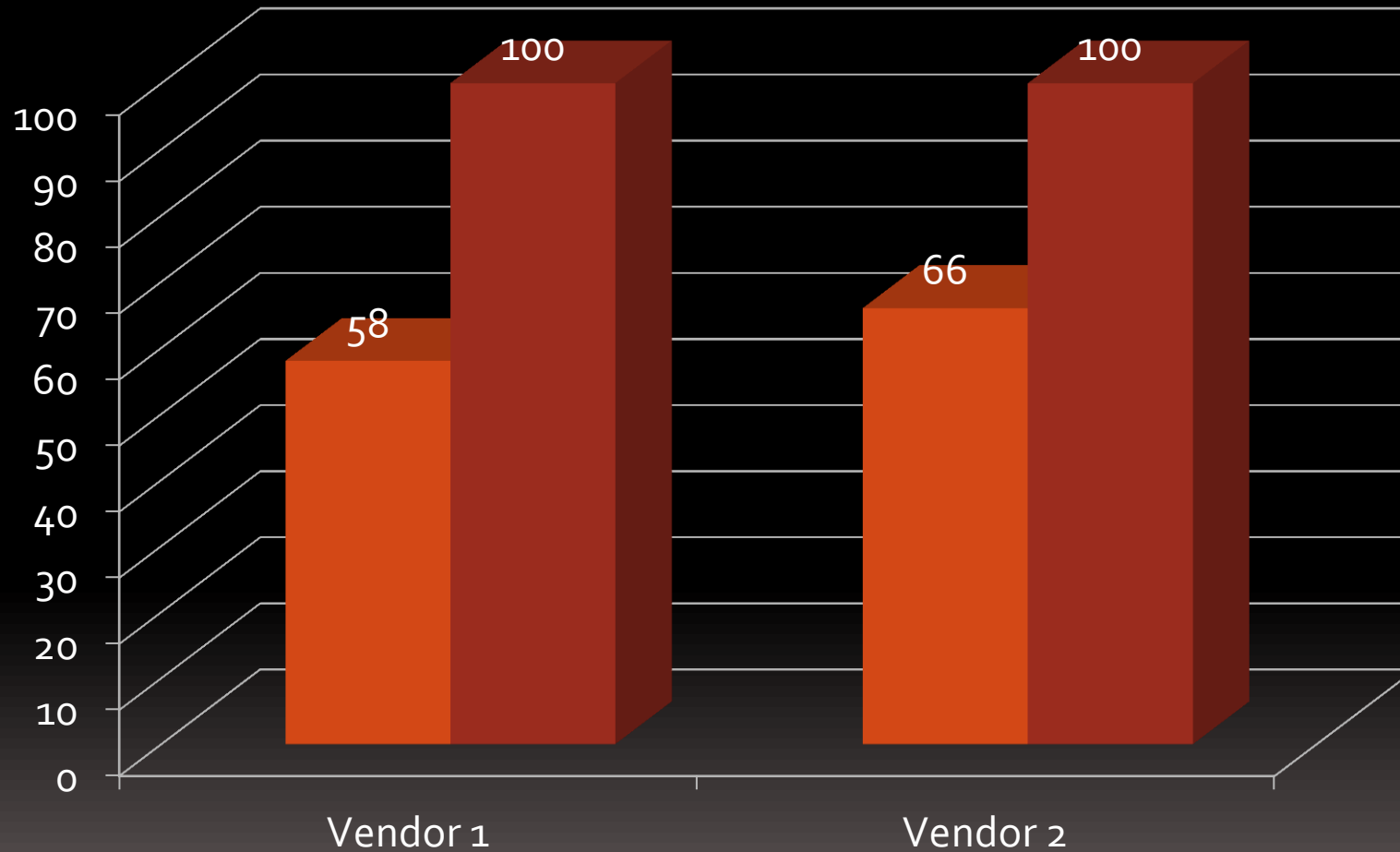
Internet | Protected Mode: On 125%

<http://www.microsoft.com/protocols>

# “BlueLine” Technical Document Testing Program of Windows (as of 03/09)

- 222 protocols/technical documents tested
- 22,847 pages studied and converted into requirements
- 36,875 testable requirements identified and converted into test assertions
  - 69% tested using **model-based testing** with Spec Explorer
  - 31% tested using traditional test automation
- 66,962 person days (250+ years)
  - Hyderabad: 250 test engineers
  - Beijing: 100 test engineers

# Comparison MBT vs Traditional



- Model-Based
- Traditional

- In % of *total* effort per requirement, normalizing individual vendor performance
- Vendor 2 modeled 85% of all test suites, performing relatively much better than Vendor 1



# Spec Explorer Features

- Visual Studio add-in
- Multiple modeling styles and languages
  - Programs, patterns, diagrams
- Asynchronous & non-deterministic systems
- State machine extraction from model program
- Test code generation from state machine
- Model composition

# Model Exploration

The screenshot displays the Microsoft Visual Studio interface with the following components:

- Top Panel:** File Edit View Project Build Debug Team Data Tools Architecture Test Spec Explorer Analyze Window Help. Debug mode, Mixed Platforms, AssumeShare.
- Toolbox:** Contains icons for search, zoom, and other navigation tools.
- Main View:** A state transition diagram for 'AllSync.seexpl'. States are represented by circles (S0-S35) and transitions by arrows with event labels like 'event TreeConnectedResponse(1,1,1,DISK)', 'event ErrorResponse(CREATE,1,1)', 'CreateRequest(1,1,1,Open,"smb2test")', etc.
- Bottom Panel:** A smaller diagram for 'AsyncCreateClose.seexpl' showing a similar state transition structure.
- Bottom Status Bar:** States: 21/36 | Steps: 28/43 | Requirements: 0/13 | Bounds: 0/0 | Errors: 0/0 (top); States: 24/37 | Steps: 51/64 | Requirements: 0/9 | Bounds: 0/0 | Errors: 0/0 (bottom).
- Right Panel:** Exploration Manager and Solution Explorer.

**Exploration Manager:** Exploration finished. 13.181 seconds, 37 states.

Machine	Test Enabled
AllSync	false
AllSyncTwoFiles	false
AllSyncRequirementReduction	false
AsyncCreateClose	false
TestSuite	true
CheckAllSyncForNoAsync	false
CheckAsyncCreateCloseForNoAsync	false

**Solution Explorer:** Solution 'smb2' (4 projects)

- Solution Items
  - localtestrun.testrunconfig
  - README.txt
  - smb2.vsmDI
- Adapter
  - Properties
  - References
  - Messages.cs
  - Smb2Adapter.cs
  - Smb2MessageUtils.cs
- Model
  - References
  - Config.cord
  - Model.cs
- ModeledTests
  - Properties
  - References
  - SMB2TestClass.cs
  - TestSuite.cs
- Security

**Bottom Status Bar:** Error List | Test Results  
'AsyncCreateClose' includes 37 states, 64 steps, 9 requirements, 0 errors, 0 non-accepting end states, 0 bound hit.



# Give it a try...

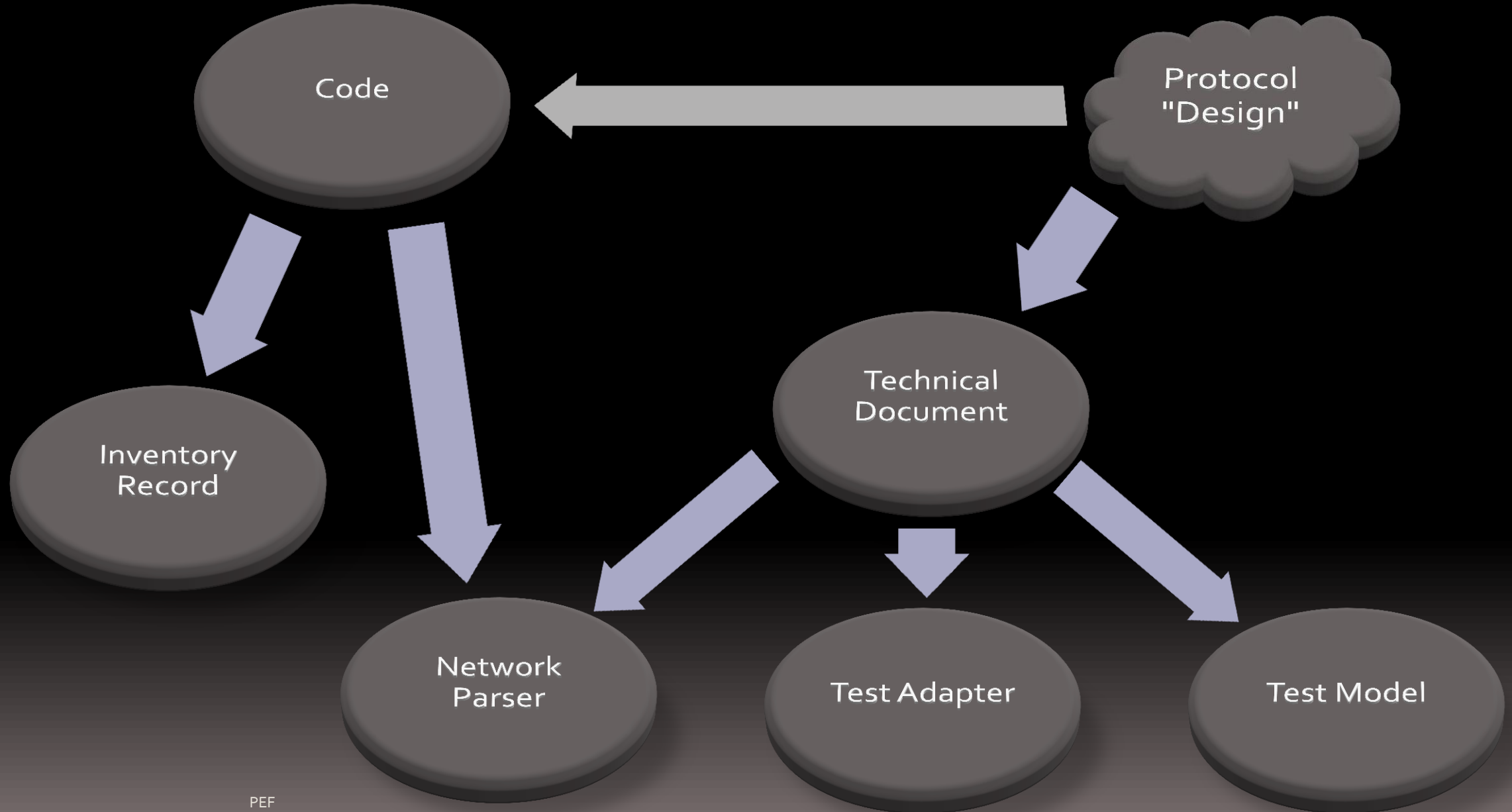
- Microsoft offers Spec Explorer 2010 as preview technology free of charge via MSDN DevLabs:  
<http://msdn.microsoft.com/devlabs>
- Licensing allows for commercial use
- Academic institutions can join MSDN Academic Alliance for access to Visual Studio 2010



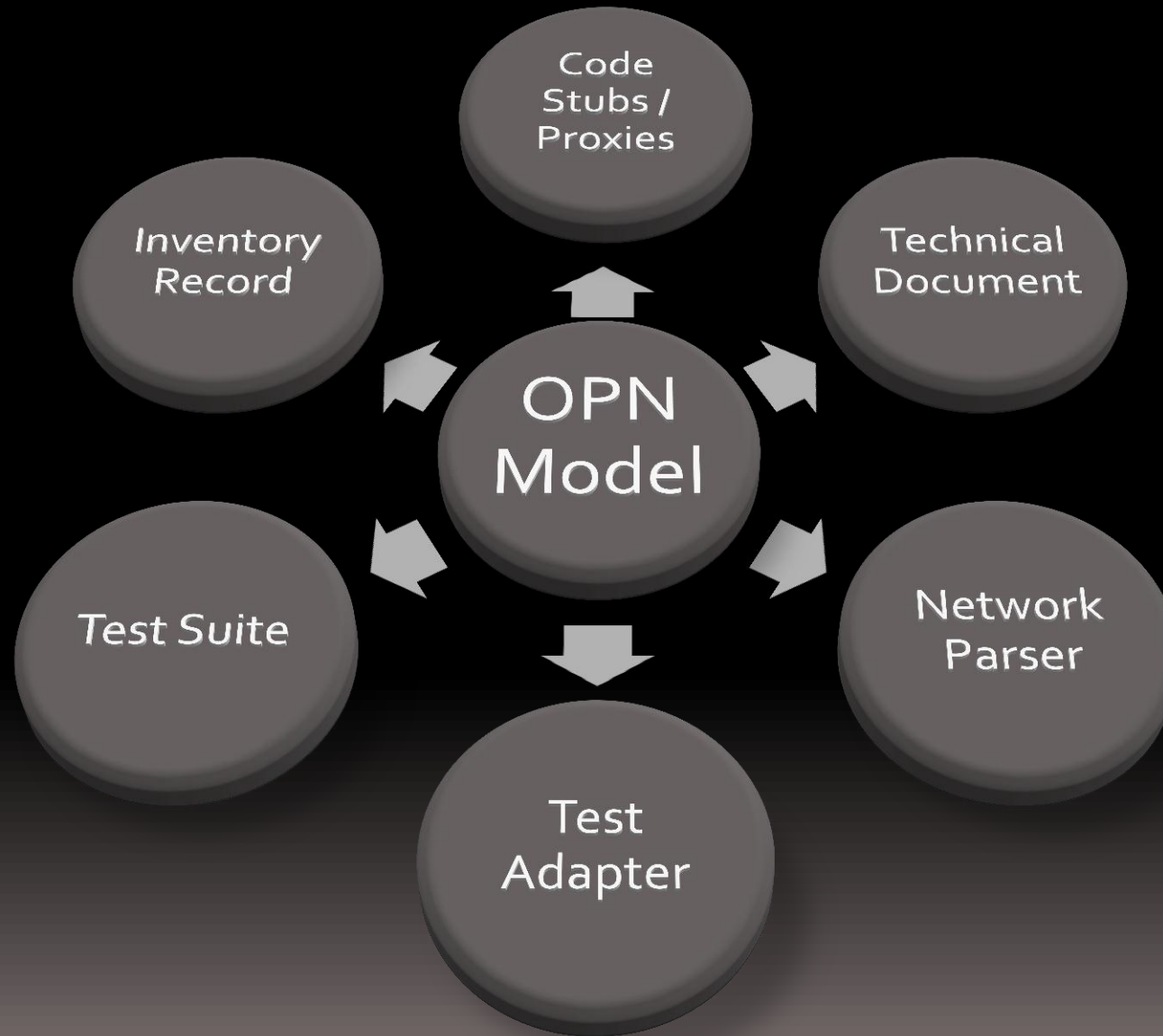
# Moving Forward: The Challenges

- Multiple masters
  - Specs, Code, Parsers, Models, Test Suites, Inventory
  - Efficiency and accuracy of creation / maintenance hard
- Verification
  - Need to improve efficiency
  - Need to reduce subjectivity
- Difficulty capturing messages
  - High bandwidth
  - Compression, encryption, and fragmentation
  - Virtualization, network stack offloading

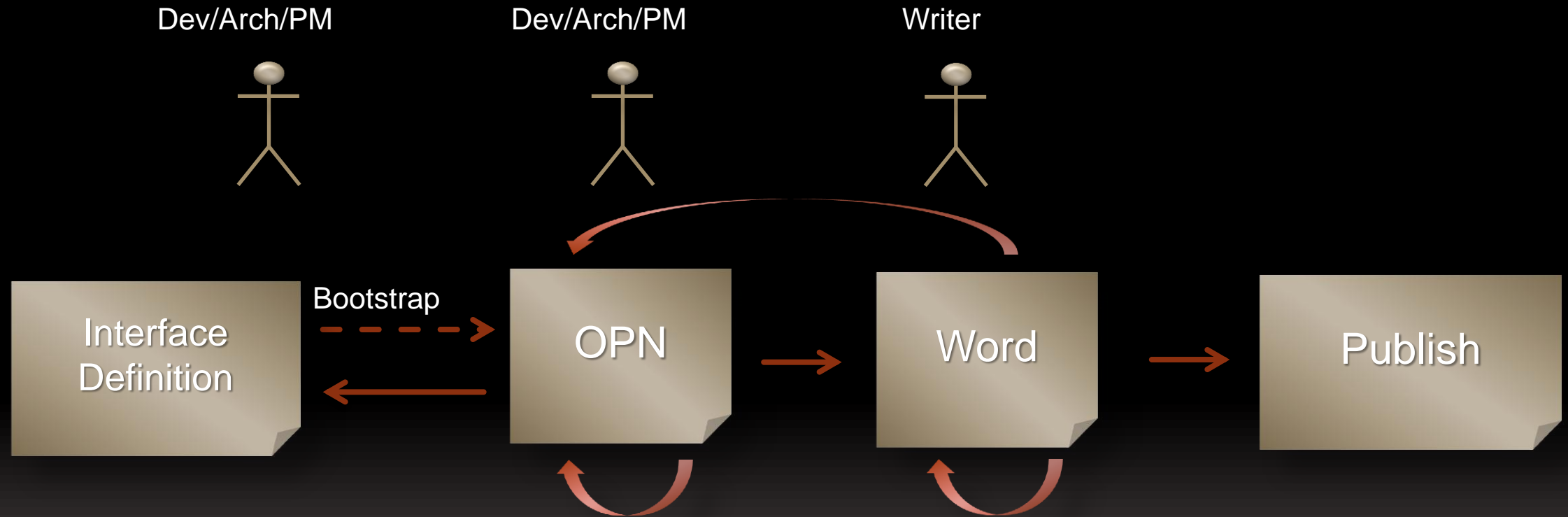
# Present



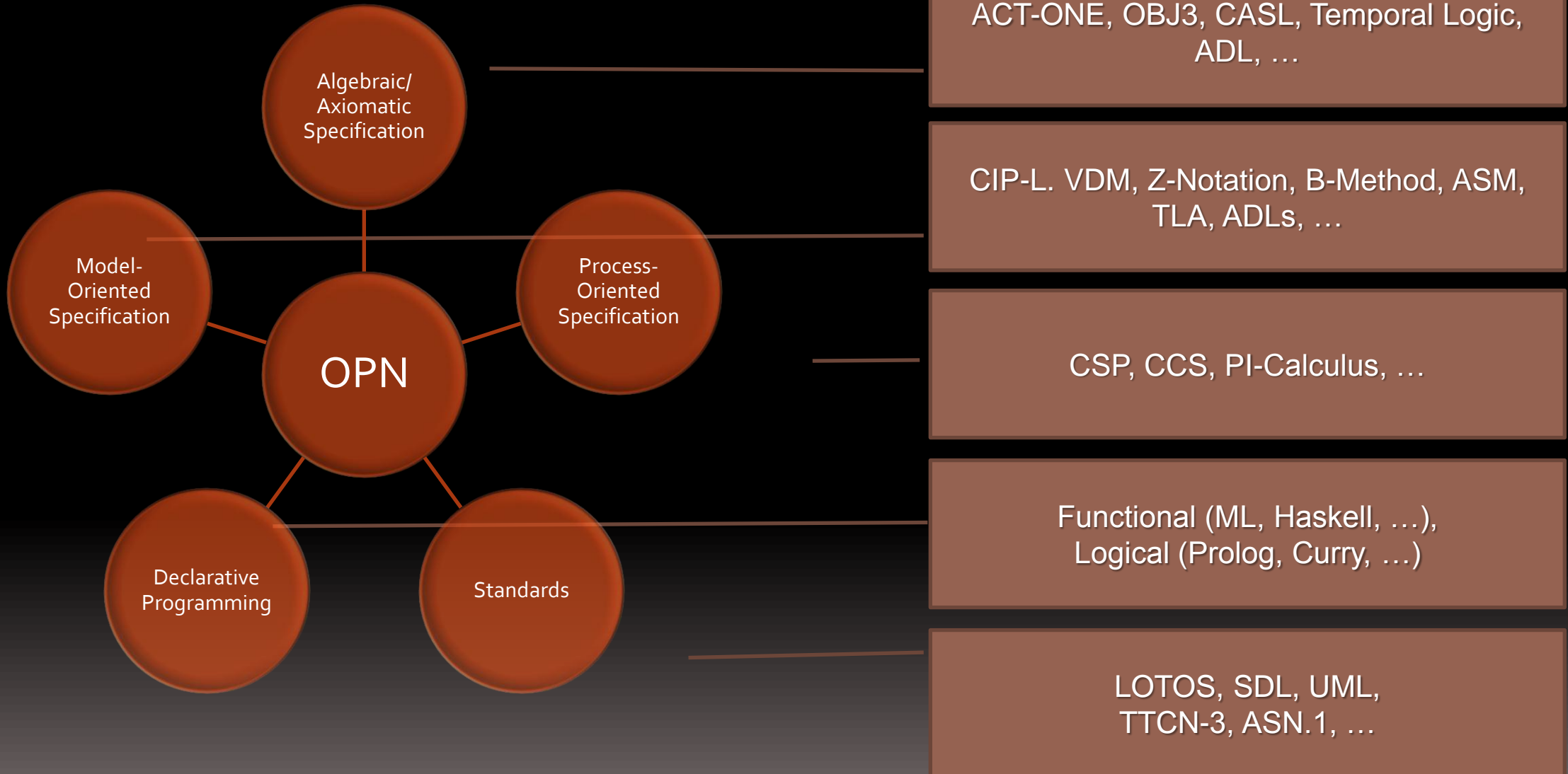
# Future – Open Protocol Notation (OPN)



# Document Generation

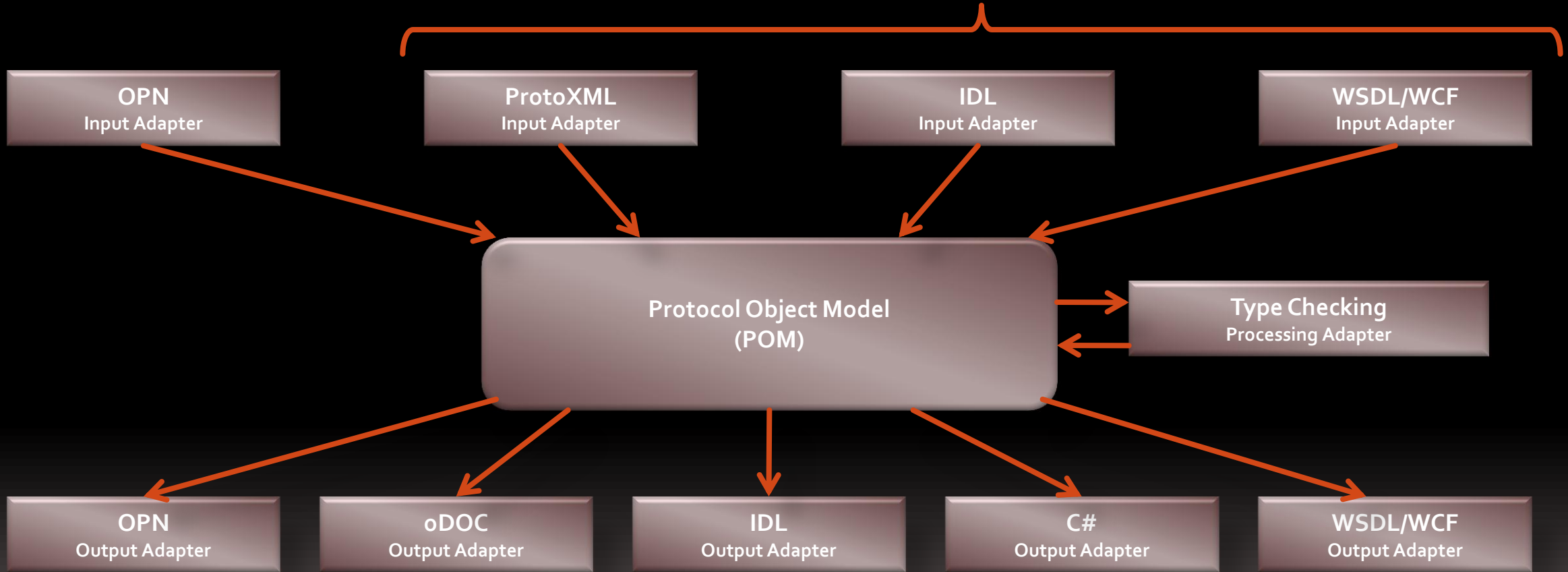


# Language Concepts



# The Protocol Object Model (POM)

Bootstrapping



# Down the road

- Extended Consistency Checking
  - Matching analysis
  - Architecture checking
- Model-Checking and Simulation
  - Symbolic state space exploration (as in Spec Explorer)
- Test generation
  - Traversals on the result of state space exploration
- Architecture exploration
  - Enumeration of valid configurations
- Code-Stub generation and contract injection
  - Get assertions from the model into the code



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