

Microsoft Robotics Studio in Education

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Microsoft Robotics Studio

- A development platform for the robotics community, supporting a wide variety of users, hardware, and application scenarios

Microsoft® **ROBOTICS STUDIO**

Runtime

- Concurrency
- Services infrastructure

Authoring Tools

- Simulation Tool
- Visual Programming Language

Services and Samples

- Samples and tutorials
- Robot services
- Robot models
- Technology services

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

MSRS today

- v1.0 released December 2006
- v1.5 imminent (July 2007)
- ~65MB download (recent beta 1.5), ~10 min install
- No cost for academic and non-commercial use, full product, not an “eval version”!
- No MSDNAA membership required – though that’s a no-brainer to join! ☺
- Runs on Windows & .NET
 - *But your robot certainly does not have to!*
- Tested and supported to work on C++, C#, VB, Javascript, IronPython
 - *But any .NET language should work, including F#, Scheme, Smalltalk, etc.*
- >100 services already built-in, including generics, simulations, robot platforms:
 - iRobot Create, Pioneer, BoeBot, fischertechnik, KHR-1, Lego NXT & RCX, ... (no constraints on others)
- Many 3rd party services emerging for other robots and functions:
 - Scribber, SRV-1, VEX, Traxster, Lynxmotion, ER1, Phidgets, KUKA ... (see web for more)
- Comprehensive walkthrough-style tutorials (>30), videos (8)
- Active community site
- >100k downloads to date
- ~40 commercial partners
- At least 10 active academic research projects known (but we don’t have a way to track this today)

What's different about MSRS?

- **Core runtime:**
 - Managed code (.NET, Java, etc.) abstracts memory management and certain security concerns from the programmer
 - MSRS adds *concurrency* and *distribution* to this list
 - Provides a pervasive services-oriented paradigm for development
 - REST architecture – the abstract paradigm of the web
http://en.wikipedia.org/wiki/Representational_State_Transfer
 - A way forward for the programmers of tomorrow?
 - Leverages your existing web tools and skills (browser, XML, etc.)
- **Optional** modern game-quality 3D simulator, with physics, complete transparency between sim/real implementations
- **Optional** Visual Programming Language entry point to development, complete transparency between VPL/native code
- **Industrial-strength, commercial-ready platform, free for educational use**

REST

(Representational State Transfer)

- “RESTafarians” argue that the Web scaled so well as a direct result of key design principles:
 - Application state and functionality are divided into **resources**
 - Every resource is uniquely addressable using a **universal syntax** for use in **hypermedia links**
 - All resources share a **uniform interface** for the transfer of state between client and resource, consisting of
 - A constrained set of **well-defined operations**
 - A constrained set of **content types**, optionally supporting **code-on-demand**
 - A protocol that is:
 - **Client/Server**
 - **Stateless**
 - **Cacheable**
 - **Layered**
- REST's client-server separation of concerns simplifies component implementation, reduces the complexity of connector semantics, improves the effectiveness of performance tuning, and increases the scalability of pure server components.
- Layered system constraints allow intermediaries for further scalability — proxies, gateways, and firewalls.
- REST enables intermediate processing by constraining messages to be self-descriptive:
 - Interaction is stateless between requests, standard methods and media types are used to indicate semantics and exchange information, and responses explicitly indicate cacheability.
- **Roy Fielding** defined REST in his doctoral thesis in 2000 – and is one of the principle authors of HTTP
- As is **Henrik Frystyk Nielsen** – Tim Berners-Lee's first graduate student, and a key architect of MSRS

Who's MSRS for?

(in its native form, straight out of the box)

- **Commercial**
 - Robot application developers
 - Robot platform vendors
 - Robot component suppliers
 - Potential: non-traditional robot applications
- **Academic**
 - Educators who want explore teaching programming with robotics, perhaps especially REST-style programming
 - Researchers who want a “plumbing layer” for robotics
 - Researchers who want a simulator for robotics
 - Researchers who want to extend MSRS for additional scenarios, e.g. traditional beginner programming, non-robot devices
- **Hobbyists**
 - Sophisticated homebrew systems with an emphasis on software
 - Tinkerers, Explorers, Kids, Parents, Everyone!
- Note: trivial use of MSRS in its native form is **easy**. But to use its full power, sophisticated software development skills, especially with .NET (or Java) experience, is necessary and there is a learning curve. This is why so much effort has been put into tutorials and support materials – and more will follow, e.g. books, third party education materials. Feedback?

MSRS for Education (excl. research; primary scenarios only)

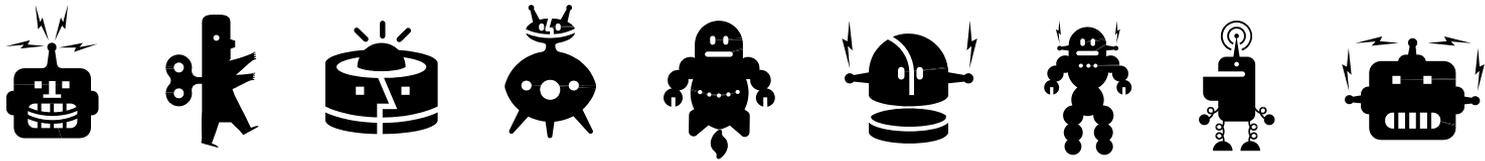
(Disclaimer: Stewart's opinions)

- **Teaching programming/CS at university level and advanced HS**
 - MSRS ready to use in certain classes today
 - 30 tutorials to leverage – easy port to curriculum contexts, e.g. labs
 - But it's a sophisticated professional software platform, so best for advanced level courses (cf. full Visual Studio & .NET)
 - Good where you want to teach the REST paradigm, differentiated from conventional web programming
 - Flexible hardware options, with ready-to-run services for common educational robots already “in the box”
 - Neat 3D simulation option to engage students exposed to computer games
 - Visual Programming Language is an easier entry path for less experienced programmers
 - MSRS was not designed for novice traditional programmers per se, but we're interested in feedback from instructors
- **Teaching beginner programming at university level and HS**
 - Same as above
 - However, the complete infrastructure may be overwhelming at this level
 - One raison d'être for IPRE (Georgia Tech/ Bryn Mawr) – we are researching this very problem space!
 - IPRE expects to deliver a thoroughly-proven teaching-specific software solution, wrapping MSRS complexities and adding pedagogical features demanded by the beginner programmer class
 - Unless you want to explore “REST-first”, perhaps – feedback please
- **Teaching engineering/robotics**
 - Same as above
 - Again, the full software infrastructure may be daunting for engineers with shallow software skills
 - Basic use of the platform capabilities very possible though, using higher level tools such as VPL and the simulator
 - Can provide a thorough and flexible plumbing layer for advanced robots
 - Possibly a way to introduce REST-style programming to engineers – feedback please



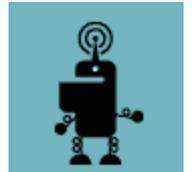
A word on IPRE & MSRS

- **IPRE**
 - The Institute for Personal Robots in Education, <http://roboteducation.org>
 - Hosted at Georgia Tech with Bryn Mawr College
- **Vision**
 - A personal robot for every student programmer
 - A broad community of practitioners in educational robotics
- **Goal**
 - Rigorously research the effectiveness of a special purpose personal robot in the CS1/CS2 classroom, with the aim of increasing attraction and retention
 - Share the results of assessment and materials so that others in the community can adopt the approach
- **MSRS role in IPRE**
 - A software tool to provide hardware abstraction, programming language independence, additional capabilities, & accelerate the development time
 - Myro is the name of the software platform for IPRE
 - Metaphor: Myro has “MSRS inside”
 - Put another way: Myro is a “pedagogical wrapper” for MSRS



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