Microsoft Robotics Developer Studio 2008

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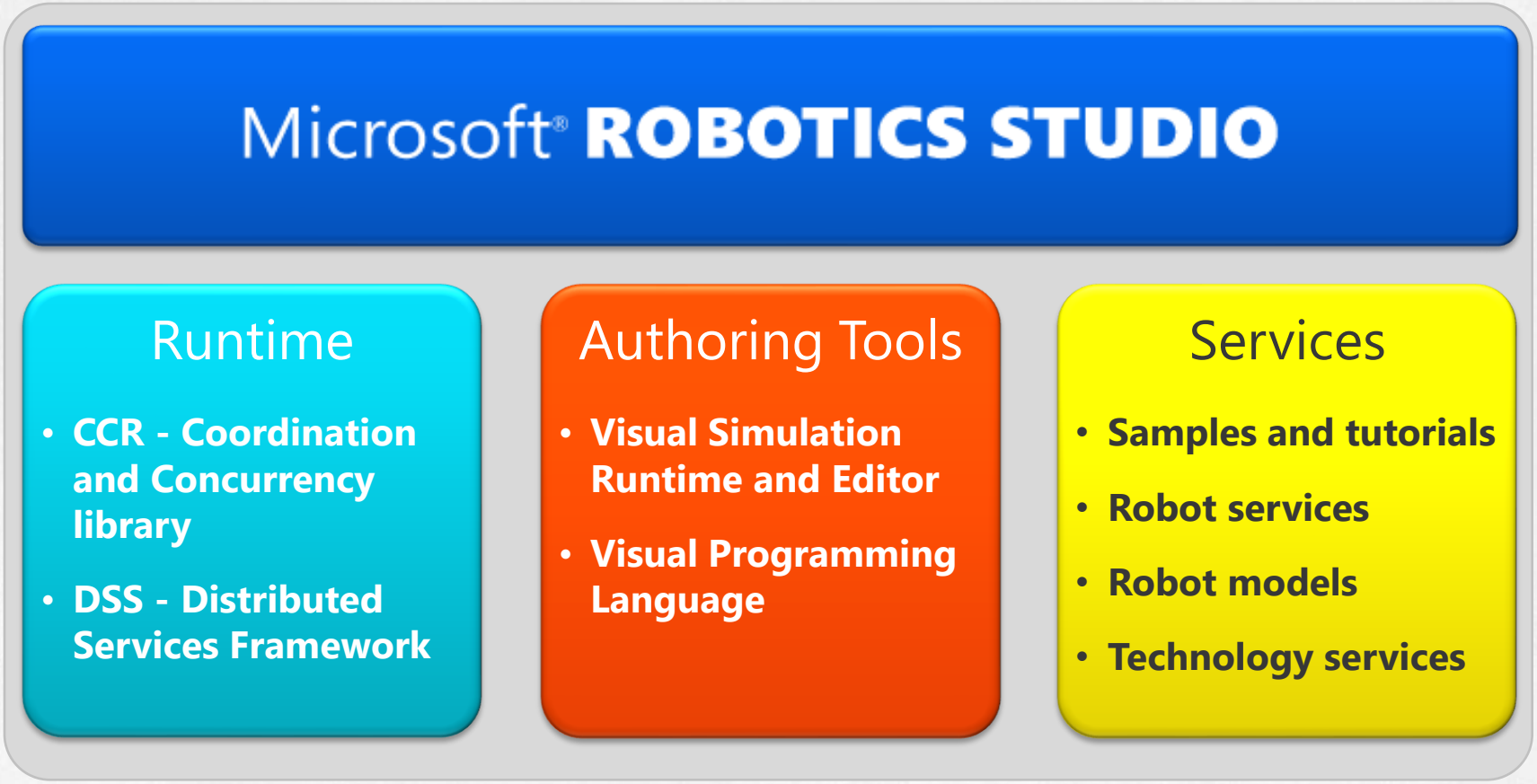
Microsoft Robotics Developer Studio 2008

- **Reusable components**: Introduces a paradigm that facilitates reuse
- **Standardization**: Introduces a hardware abstraction paradigm
- **Concurrency and distributed computing**: Introduces CCR and DSS to greatly simplify these tasks
- **Simulation**: Introduces a high-fidelity, extensible virtual world
- **Barrier to Entry**: Introduces a Visual Programming Language to make the advanced features more accessible to newcomers.

VPL + Simulator

Microsoft Robotics Developer Studio 2008



What is Concurrency?

"***Concurrency*** *is a property of systems in which several computations are executing simultaneously, and* ***potentially interacting*** *with each other."*

"*The design of concurrent systems often entails finding reliable techniques for* ***coordinating*** *their execution,* ***data exchange****, memory allocation, and* ***execution scheduling*** *to minimize response time and maximise throughput"*

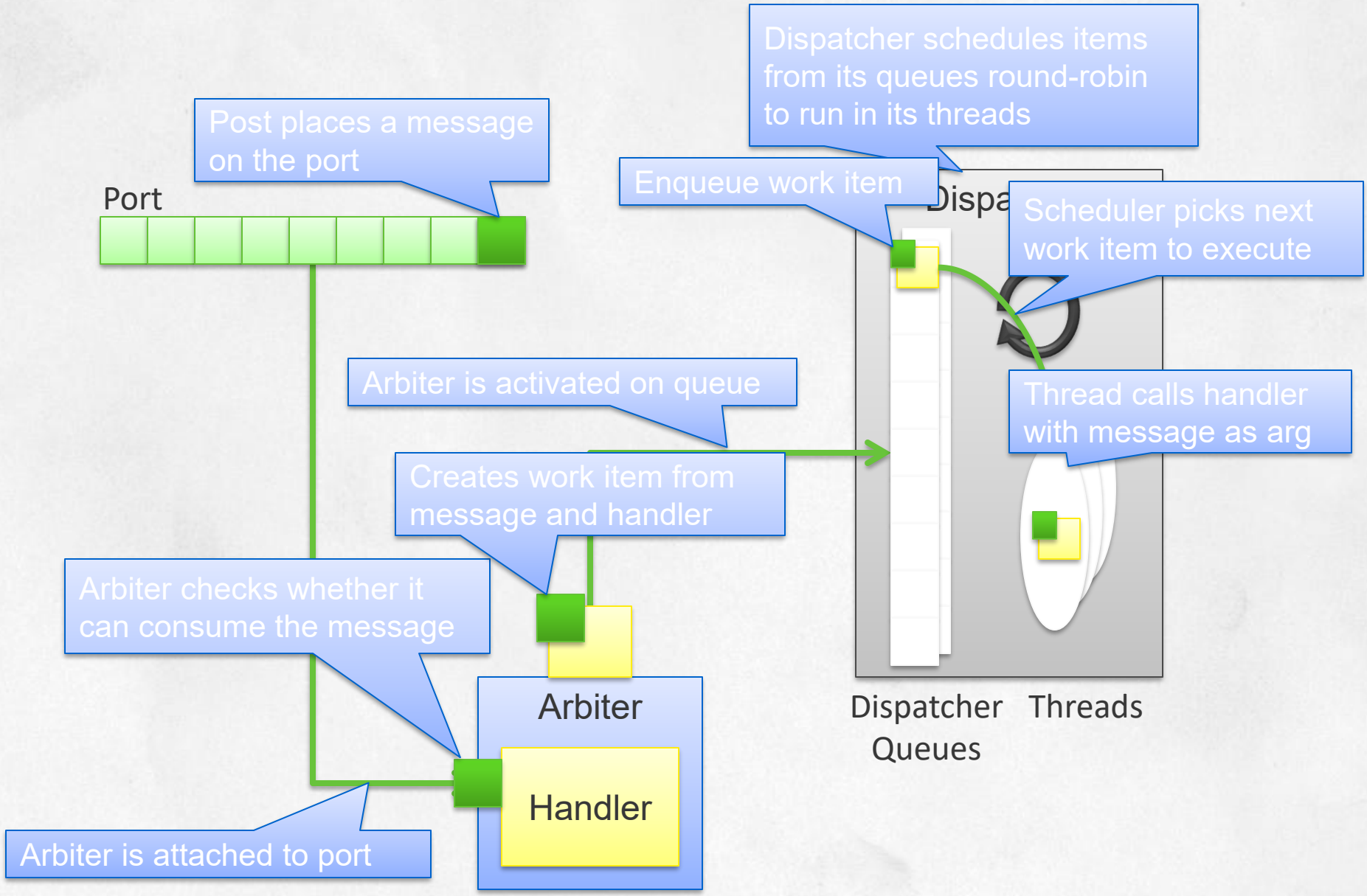
Wikipedia

Why CCR?

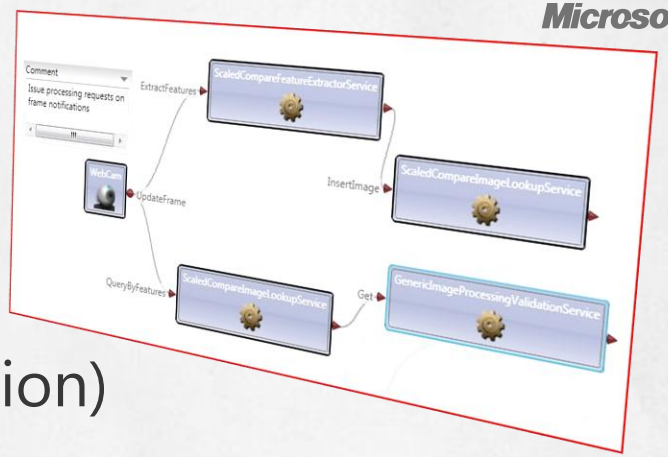
- **C**oncurrency
  - Process many **tasks** (load-balance across cores)
  - **Scalability**, Responsiveness
  - Exploit latency
- **C**oordination
  - Exercise control without blocking threads
  - Orchestrate **asynchronous** operations
  - New mechanism to handle **failure** for concurrent, asynchronous code
- **R**untime
  - Advanced scheduler with fairness, **throttling**
  - Extensible primitives

CCR Programming Model

- Asynchronous in-process message passing
  - No explicit threads, locks, semaphores!
- Task scheduled based on message availability
  - Data-dependency scheduler
  - Models concurrency
- Coordination primitives (join, choice, …)
  - Composition of data-driven components
- Iterative tasks
  - Express sequential control flow of asynch. tasks


Dispatcher schedules items from its queues round-robin to run in its threads
Post places a message on the port
Port
Enqueue work item
Scheduler picks next work item to execute
Arbiter is activated on queue
Thread calls handler with message as arg
Creates work item from message and handler
Arbiter checks whether it can consume the message
Arbiter
Handler
Arbiter is attached to port
Dispatcher Queues
Threads

Why DSS?



- Robust
  - Deep **isolation** (data and execution)
  - Contain and manage **failure**
- Composable
  - Protocol and runtime support to create, manage, deploy, data driven applications
  - Runtime and tool support for service bindings
  - Publication/subscription integrated with structured state manipulation
- Observable
  - Service is a living document addressable through URIs
  - Consistent mechanism for configuring, managing and controlling access

- Concurrency & Coordination
- State-Driven Composable
- Flexible Development

- Used by MySpace, Tyco & Siemens

SIEMENS

tyco
a vital part of your world

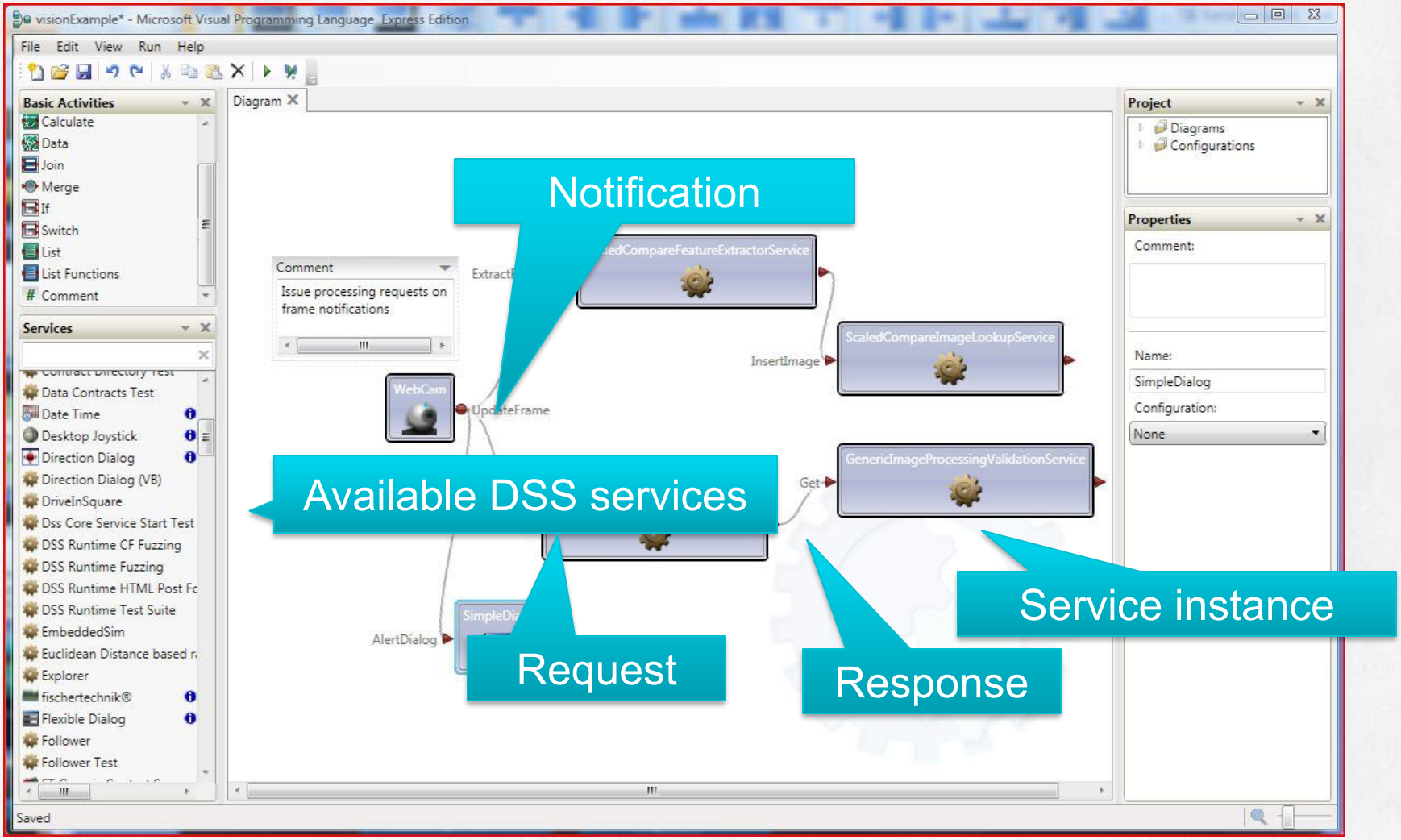
myspace
.com

Programming MRDS

- Writing managed code
  - Any **managed** code language
  - C# provides Iterator mechanism for concise code
- Visual Programming
  - **V**isual **P**rogramming **L**anguage
  - DSS Manifest Editor

Visual Programming Language

Orchestrating DSS services with dataflow



mindstorms NXT 2.0

Lego Mindstorm NXT 2.0

Mindstorm NXT 2.0

- Estimated Price +/- $280
- 32-Bit processor
- 4 Input Sensors (Ultrasonic, Sound, Touch & Color Sensors)
- 3 Interactive servo motors

Windows CE

- Runs on Compact Framework

RoboCup

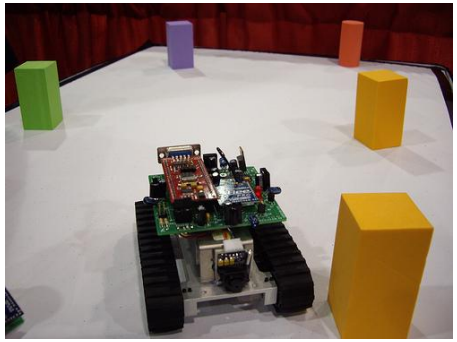
- RoboCup Rescue
- RoboCup Soccer

MRDS 2008 Licensing

Academic Edition	Researchers and Students. Free unlimited runtime distribution. Via Academic Portal.
Standard Edition	Professional Developers. Free unlimited runtime distribution $499
Express Edition	Hobbyists. Not permitted to distribute runtime $Free

More information at http://microsoft.com/robotics

*"Students really appreciate the Visual **Simulation** Environment that enables them to go home, work on their algorithms, create different prototypes, and then run them on the robot in the lab the next morning."*



*"Using CCR and DSS our developers created a **complex** robotics application in just **two** months. Using our old development tools that project would have required at least one year."*

The Future?

*"A **driverless car** is an autonomous vehicle that can drive itself from one point to another without assistance from a driver."*

- DARPA Grand Challenge
- RoboChamps Urban Challenge


Summary

- Simpler concurrency and distributed computing
- Reusable components and standardization
- Lower barrier to entry
- All of these advantages are now available for mobile, embedded, desktop and server platforms.

Additional Resources

Technical Resources

- Microsoft Robotics
  http://www.microsoft.com/robotics/
- Microsoft Robotics Developer Centre
  http://msdn.microsoft.com/en-us/robotics/default.aspx
- Coding4Fun: Microsoft Robotics Studio and Lego Mindstorms NXT
  http://blogs.msdn.com/coding4fun/archive/2007/07/16/3902344.aspx
- CCR at MySpace
  http://channel9.msdn.com/shows/Communicating/CCR-at-MySpace/

Training Resources

- Learn
  http://www.microsoft.com/robotics/#Learn

Community Resources

- Microsoft Robotics Blog
  http://blogs.msdn.com/MSRoboticsStudio/

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