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ANSA Phase III

May TC Presentation: Programming the Net

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Abstract

The Net will turn into an environment populated by services and agents. Emerging technologies such as Java, Tcl and Telescript are competing in a bid to become the accepted "base-level" programming languages for the Net environment.

The first half of this presentation introduces Net programming technologies and speculates how these will influence the architecture of systems built on the Net. This vision includes the idea of using the existing Web as a common backbone which connects other more specialized Net environments.

The second half introduces and demonstrates an extensible, script-based Web server called Changeling. The Changeling prototype has been developed to learn more about script-based programming of the Net.

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Contents

- **Part 1: Net programming technologies**
- **Part 2: Changeling Web Server Demo**



What is this about?

- **Programming Net-based applications, clients, servers...**
- **Net-based programming characteristics: script-like and safe**

Executable content

- **Dynamic protocol installation**
 - **The Net isn't static**
 - **Invent and distribute new protocols and interfaces**
- **Remote computation**
 - **Harness power of remote CPUs**
 - **Off-load servers, distribute load to clients**
 - **Support mobile agents, workflow**
 - **Software upgradable devices**



- **Less communication**
 - **Minimize communications**
 - **Support intermittent connectivity (eg. PDAs)**
 - **Remote decision making (eg. space travel, CIM systems)**

OO, model included, introspective

- **Net == collection of interworking objects**
- **Include model (eg. repositories) in infrastructure**
- **Introspection -- “How do I talk with that object?”**



Safety

- **Protect receiver from agent --- Possible**
 - Provide only safe, well understood primitives to agents
 - Limit resource consumption (CPU time, memory, file space)
 - Authenticate incoming agents
- **Protect agent from receiver --- Not really possible**
 - Rely on trusted sites
 - Agents carry minimal necessary rights and sensitive data
- **Protect agents from agents --- Difficult**
 - Must think about emergent behaviour
 - Eg. feature interactions, viruses



Emerging Net Technologies

User Interfaces	HotJava	Netscape	Mosaic	MagicCap	Windows95
User Level Models	VRML	HyperDocs		Personal Link	MS World
Addressing	URLs		URCs	tickets	GUID
Languages	Java	Tcl	C/C++	Telescript	Visual Basic
OO Models	OpenDoc		CORBA	Telescript	OLE/COM
Protocols	HTTP	S-HTTP	IIOp		



Sun's Java

- See <http://java.sun.com/>
- Sun's OO language for programming the Net
 - C++ like high-level syntax --- compiled to portable byte code
 - Interpreters, presently on Solaris, soon on MacOS, Windows NT, etc.
- Security designed into the language system
 - Security checks on byte code
 - Controlled access to local resources
 - PGP authentication on its way
- HotJava Web/Net browser
 - Downloadable applets --- protocol modules, MIME-type displayers, etc.



Tcl

- See <http://playground.sun.com/~ouster/>
- High-level, interpreted, wide-spread, many extension pkgs (eg. Tk)
- Safe-Tcl --- developed for enabled-mail applications
- Sun see Tcl as a high-level glue and prototyping language
- Java for speed



Telescript

- See <http://www.genmagic.com/>
- General Magic's OO language
- Mobile Agents, Places, Teleclicks for payment
- Proprietary --- GM are quite secret about it
- Services: AT&T Personal Link Service
- PDAs: Sony's Magic Link, Motorola's Envoy



VRML

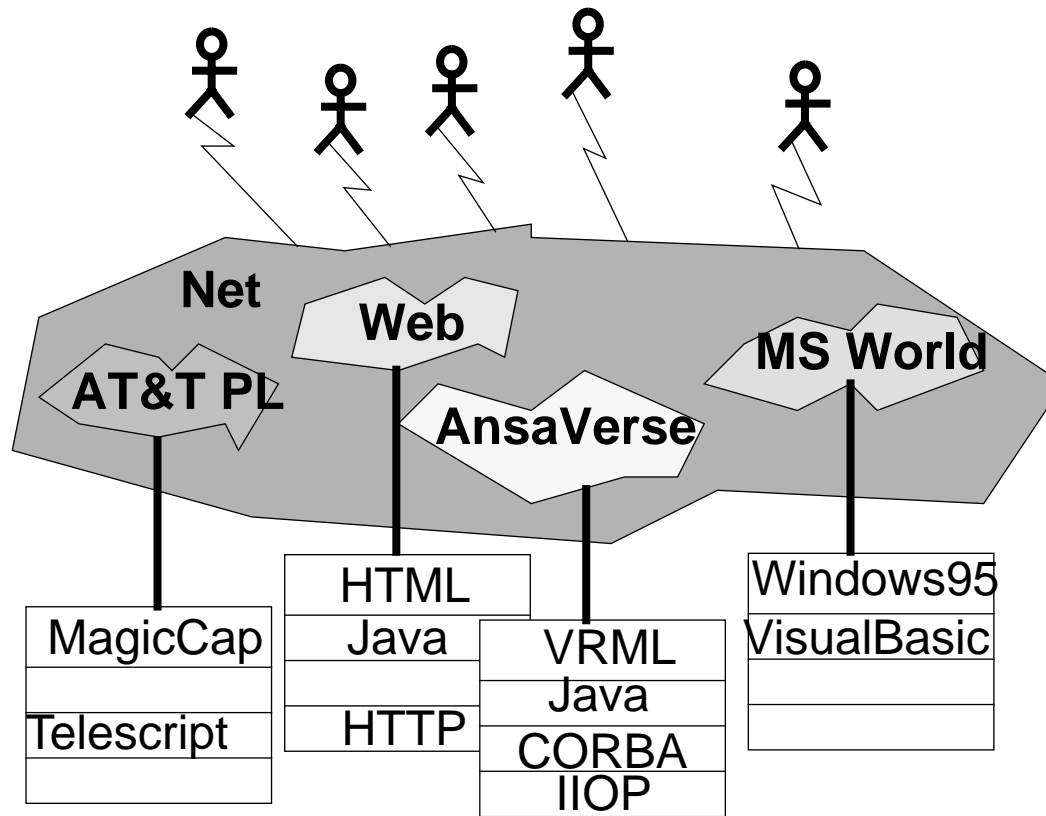
- See <http://vrml.wired.com/>
- Virtual Reality Modelling Language
- Takes the Web out of flatworld
- Based on Silicon Graphics' OpenInventor™
- SGI, Netscape and Template are integrating VRML into viewers
- In VRML 1.0 3D objects lack interactivity support...



VRML 2.0 + CORBA + IIOP?

- VRML 2.0... networked inter-object interaction?
- Requires object brokering [SGL, Labyrinth]
- Suggestion to use CORBA as the Web's OO infrastructure
 - documents --> objects
 - HTTP --> IIOP
- The Web becomes a collection of interacting objects -
-- some with a 3D graphical visualization

The Net Vision





Net Vision

- **The Net as a connected collection of cyberspaces**
 - The Web will be the common Net backbone
 - Connecting other specialized Net cyberspaces
 - Download appropriate protocol/viewer for a cyberspace
 - This is the kind of scenario that HotJava has been designed for
 - People are already creating customized cyberspaces...

Eg. OSF selling a DCE-based Web as a corporate IT infrastructure,
CommerceNet sites investigating secure transactions
- **Options for future work:**
 - IIOP protocol module to plug into HotJava browsers
 - VRML 2.0: 3D graphical objects with CORBA underpinnings
- **MARKET: Net based corporate IT infrastructures**



Part 1 Summary

- Introduced Net programming technologies
- Speculated on the architecture of Net-based systems
 - In particular, the idea of downloadable protocol/interface software for surfing customised cyberspaces

Part 2: some practical work...



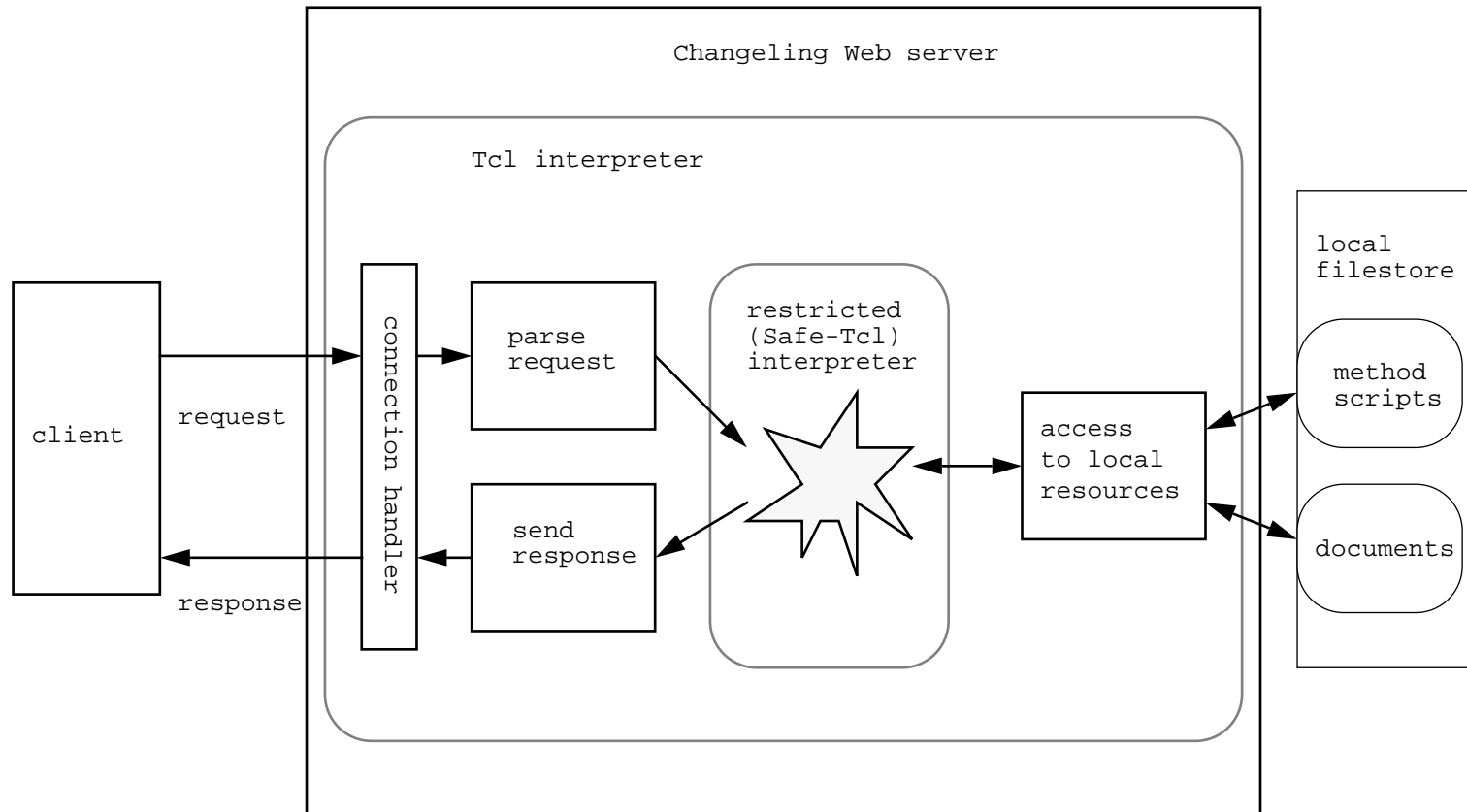
Changeling Web Server

- **Aim:**
 - **Build a Safe-Tcl script-based Web server with an extensible set of methods**
- **Purpose:**
 - **Learn about Net technology: safe scripting, HTTP**
 - **Learn about in-service software upgrades**
 - **No present server implements HTTP/1.0 extension methods**
 - **Use as a basis for prototyping other Web related work**
 - **(Tcl --> Java)**



Architecture

- Kernel management methods: INFO, INSTALL, REMOVE, REGISTER, etc.
- Standard library methods: GET, POST, HEAD, etc.
- User defined methods: ...





The Changeling Interactive Tutorial

- A series of Web pages which take you through the cycle of:
 - Becoming a registered Changeling user
 - Posting then getting a document
 - Installing, invoking and removing a new method
 - Unregistering as a Changeling user



References

- **APM 1434 Scripts and Agents: Introduction and Work Proposal**
- **APM 1453 The Changeling Web Server**