Redesigning and Enhancing the UWAgent Execution Engine

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CSS 497 Autumn Colloquium
Friday, December 9th, 2005

What is UWAgent

- Java-based mobile agent execution platform
- UW Bothell Distributed Systems Laboratory
- Supports the AgentTeamwork grid computing middleware system

AgentTeamwork People

Project Accomplishments

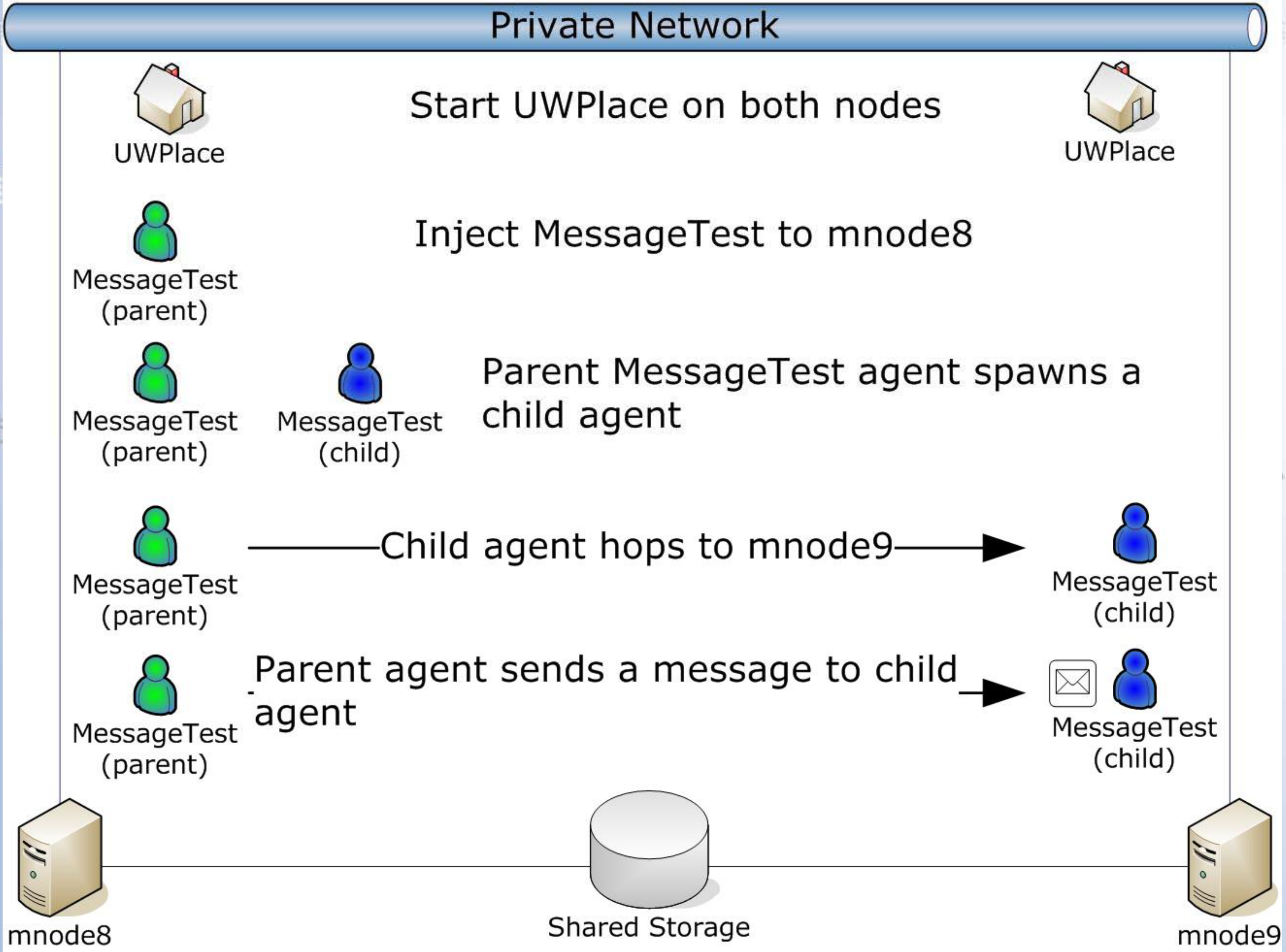
- Replaced Java RMI with Java sockets
- Implemented three new features
  - Navigation over gateways
  - Monitor commands
  - Secure Communication
- Tested for class name collision
- Refactored existing code

Why Use Mobile Agents

1. Reduce network load
2. Overcome network latency
3. Encapsulate protocols
4. Execute asynchronously and autonomously
5. Adapt dynamically
6. Naturally heterogeneous
7. Robust and fault-tolerant

Danny B. Lange and Mitsuru Oshima

Navigation and Communication on a Local Network



Start UWPlace on both nodes

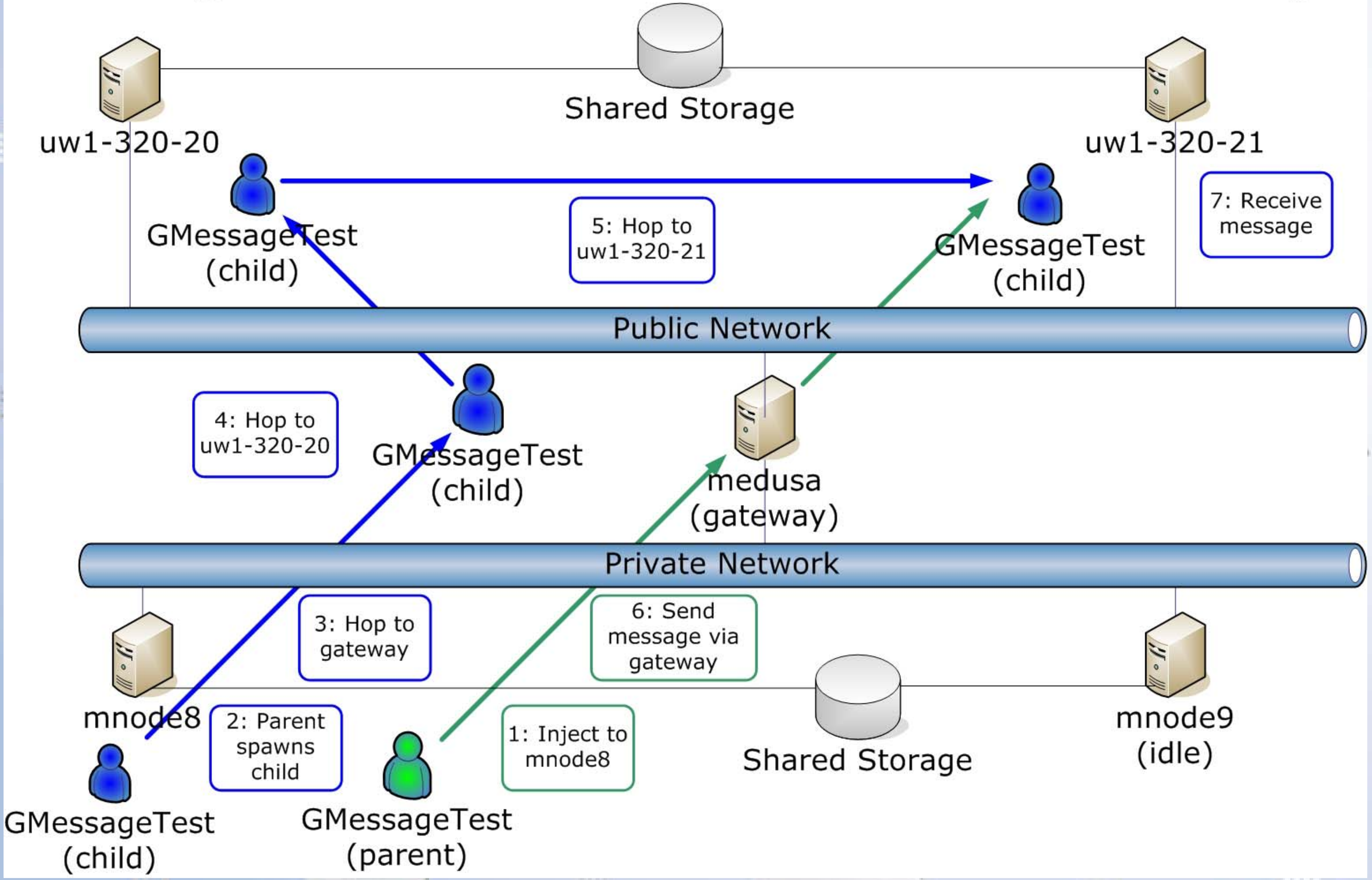
Inject MessageTest to mnode8

Parent MessageTest agent spawns a child agent

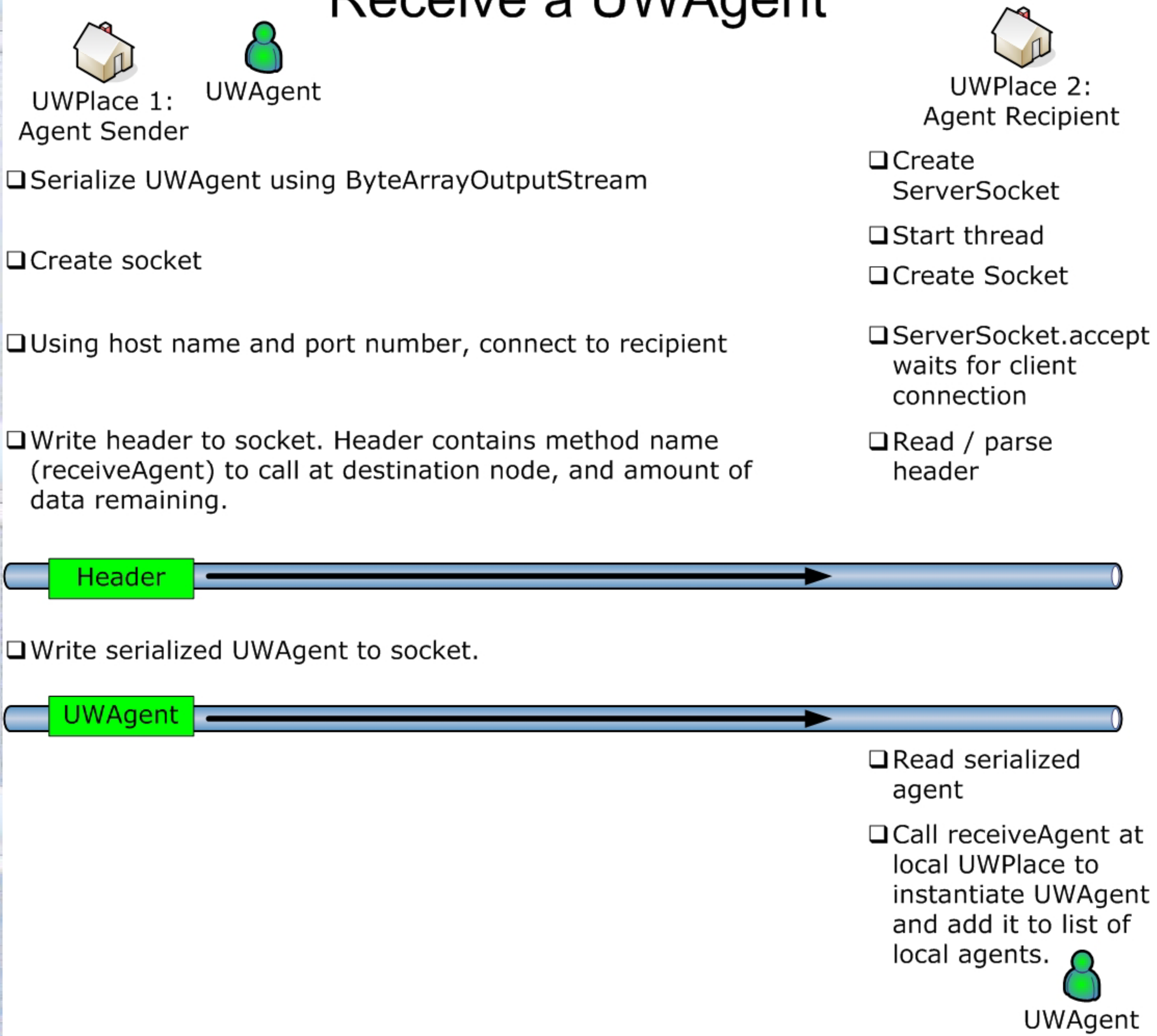
Child agent hops to mnode9

Parent agent sends a message to child agent

Navigation and Communication over a Gateway



Using Java Sockets to Send and Receive a UWAgent



UWPlace 1:
Agent Sender

UWAgent

- □ Serialize UWAgent using ByteArrayOutputStream
- □ Create socket
- □ Using host name and port number, connect to recipient
- □ Write header to socket. Header contains method name (receiveAgent) to call at destination node, and amount of data remaining.

- □ Write serialized UWAgent to socket.

UWPlace 2:
Agent Recipient

- □ Create ServerSocket
- □ Start thread
- □ Create Socket
- □ ServerSocket.accept waits for client connection
- □ Read / parse header
- □ Read serialized agent
- □ Call receiveAgent at local UWPlace to instantiate UWAgent and add it to list of local agents.

Why not RMI?

- `rmiregistry` process must be started and stopped manually
- The RMI communication layer must be configured properly
- Client on a gateway may send its public IP address to its server on a private network
- More control

Secure Communication

- Turned on or off from UWPlace command line
- Secure Socket classes are derived from Socket classes
- Use a certificate generated by `keytool`

Secure Communication

```
// Create a ServerSocket or an SSLServerSocket
ServerSocket srvr = null;
if (uwplace.getIsSSL()) {
    SSLServerSocketFactory sslserversocketfactory =
        (SSLServerSocketFactory)
SSLServerSocketFactory.getDefault();
    srvr = sslserversocketfactory.createServerSocket(portNum);
} else {
    srvr = new ServerSocket(portNum);
}
```

Secure Communication

```
// Create a Socket or an SSLSocket
InputStream in = null;
Socket skt = null;
if (uwP.getIsSSL()) {
    skt = (SSLSocket) srvr.accept();
} else {
    skt = srvr.accept();
}
in = skt.getInputStream();
```

Secure Communication

```
$ keytool -genkey -keystore UWAgentKeystore -keyalg RSA
Enter keystore password:
What is your first and last name?
  [Unknown]:  Duncan Smith
What is the name of your organizational unit?
  [Unknown]:  CSS
What is the name of your organization?
  [Unknown]:  UW Bothell
What is the name of your City or Locality?
  [Unknown]:  Bothell
What is the name of your State or Province?
  [Unknown]:  WA
What is the two-letter country code for this unit?
  [Unknown]:  US
Is CN=Duncan Smith, OU=CSS, O=UW Bothell, L=Bothell, ST=WA, C=US correct?
  [no]:  y

Enter key password for <mykey>
        (RETURN if same as keystore password):
```

Monitor Commands

- as (Agent Status)
- kill
- suspend
- resume

```
-- Agent status --
Number of agents: 3
ID      Name            Status
--      ----            ------
23      MonitorTest     Ready
25      MonitorTest     Running
0       UWMonitorAgent  Ready
```

Class Name Collision

- Agents can carry additional classes
- Two agents may carry a class with the same name
- Testing UWAgent for this scenario

Questions?

http://depts.washington.edu/dslab/AgentTeamwork