

## **CHAPTER 6 CONSISTENCY AND REPLICATION 291**

### **6.1 INTRODUCTION 292**

6.1.1 Reasons for Replication 292

6.1.2 Object Replication 293

6.1.3 Replication as Scaling Technique 296

### **6.2 DATA-CENTRIC CONSISTENCY MODELS 297**

6.2.1 Strict Consistency 298

6.2.2 Linearizability and Sequential Consistency 300

6.2.3 Causal Consistency 305

6.2.4 FIFO Consistency 306

6.2.5 Weak Consistency 308

6.2.6 Release Consistency 310

6.2.7 Entry Consistency 313

6.2.8 Summary of Consistency Models 315

### **6.3 CLIENT-CENTRIC CONSISTENCY MODELS 316**

6.3.1 Eventual Consistency 317

6.3.2 Monotonic Reads 319

6.3.3 Monotonic Writes 320

6.3.4 Read Your Writes 322

6.3.5 Writes Follow Reads 323

6.3.6 Implementation 324

### **6.4 DISTRIBUTION PROTOCOLS 326**

6.4.1 Replica Placement 326

6.4.2 Update Propagation 330

6.4.3 Epidemic Protocols 334

### **6.5 CONSISTENCY PROTOCOLS 337**

6.5.1 Primary-Based Protocols 337

6.5.2 Replicated-Write Protocols 341

6.5.3 Cache-Coherence Protocols 345

### **6.6 EXAMPLES 346**

6.6.1 Orca 347

6.6.2 Causally-Consistent Lazy Replication 352

### **6.7 SUMMARY 357**

## **CHAPTER 8 SECURITY 413**

### **8.1 INTRODUCTION TO SECURITY 414**

8.1.1 Security Threats, Policies, and Mechanisms 414

8.1.2 Design Issues 420

8.1.3 Cryptography 425

### **8.2 SECURE CHANNELS 432**

8.2.1 Authentication 433

8.2.2 Message Integrity and Confidentiality 441

8.2.3 Secure Group Communication 444

### **8.3 ACCESS CONTROL 447**

- 8.3.1 General Issues in Access Control 447
- 8.3.2 Firewalls 451
- 8.3.3 Secure Mobile Code 453
- 8.4 SECURITY MANAGEMENT 460
  - 8.4.1 Key Management 461
  - 8.4.2 Secure Group Management 465
  - 8.4.3 Authorization Management 466
- 8.5 EXAMPLE: KERBEROS 472
- 8.6 EXAMPLE: SESAME 473
  - 8.6.1 SESAME Components 474
  - 8.6.2 Privilege Attribute Certificates (PACs) 477
- 8.7 EXAMPLE: ELECTRONIC PAYMENT SYSTEMS 478
  - 8.7.1 Electronic Payment Systems 478
  - 8.7.2 Security in Electronic Payment Systems 480
  - 8.7.3 Example Protocols 484
- 8.8 SUMMARY 488

Web Services – Paper given in class