

MCM Technical Presentation

Sal Ledezma, Jimar Garcia, Gene Wie, Cayci Suitt

Introduction

- ✍ Importance of Technology
- ✍ Use of Technology at UCI
- ✍ Present System HW/SW

Importance of Technology

 **Gene's stuff here**

Use of Technology at UCI

- ✍ **Motion Capture Studio**
- ✍ **Department of Dance**
- ✍ **Department of Music**

Present System HW/SW

- ✍ **Music and Media Building**
- ✍ **Vicon 8 Camera System**
- ✍ **Windows-based PC's**
- ✍ **VC++, Vcafe, Ethereal, Vicon**

Defining the System

- ✍ **Network Information**
- ✍ **Camera System Interface**
- ✍ **Physical Room Layout**
- ✍ **SDK**

Computer Networks and Layered Architecture

- ✍ **Layers allow a complex system to be broken down into discrete, manageable parts.**
- ✍ **Services are defined between layers**
 - Implementation details can vary as long as services remain unchanged
- ✍ **Provide Layers of Abstraction**

Computer Networks and Layered Architecture (2)

- ✍ **In a Network Architecture, network protocols address different layers**
- ✍ **Protocols define format and order of messages exchanged and**
- ✍ **Actions taken when sending or receiving a message**
- ✍ **Examples:**
 - HTTP, FTP, IMAP, TCP, IP, POP3, UDP, IGMP, etc.

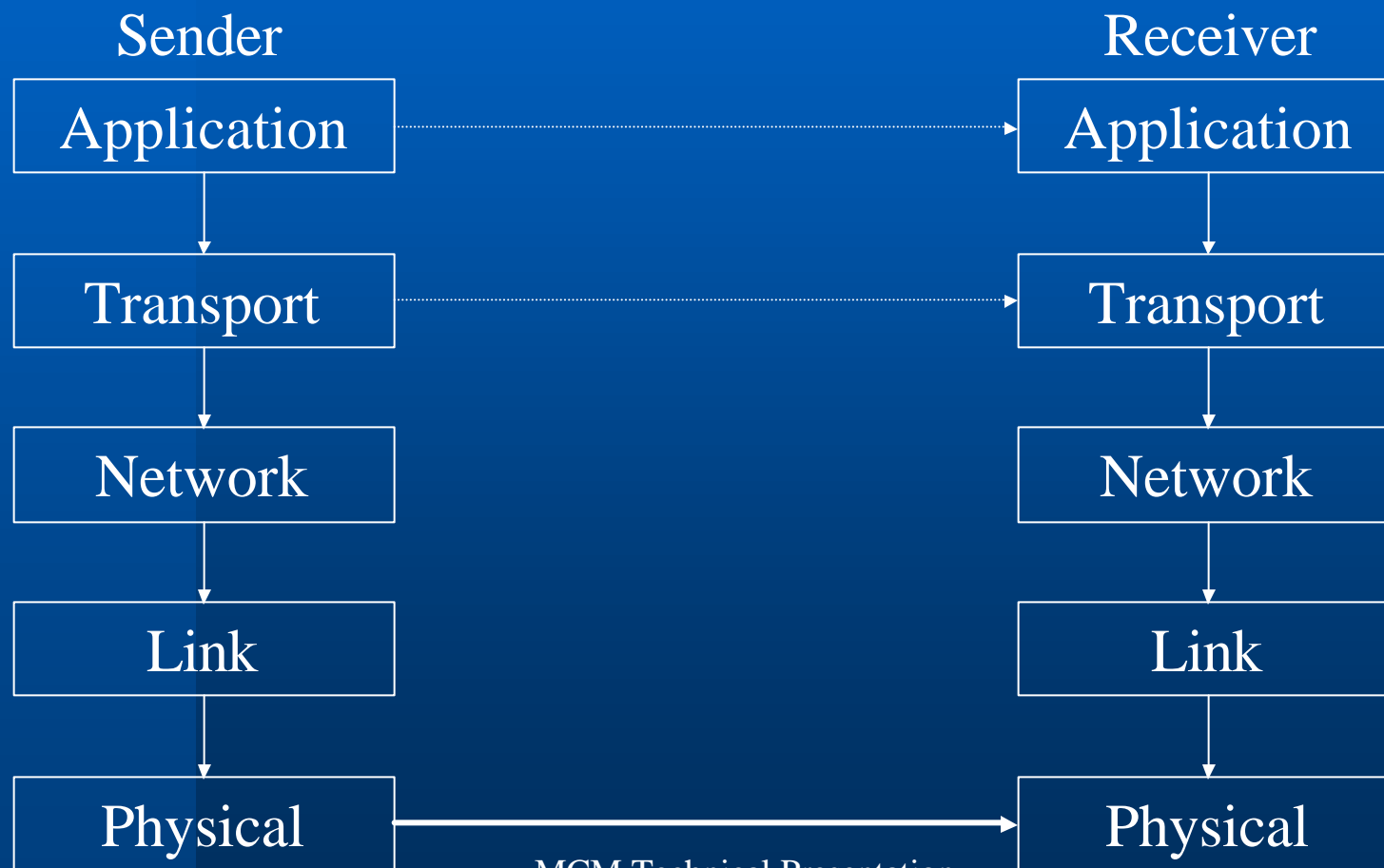
Computer Networks and Layered Architecture (3)

✍ Disadvantages of Layered Architecture:

- Each layer adds data in the form of headers
 - Extra data can slow down the network

- Redundancy
 - One layer may duplicate another layer's functionality
 - Example: several layers may implement error checking

Computer Networks and the Internet Protocol Stack



MCM Network

Closed network

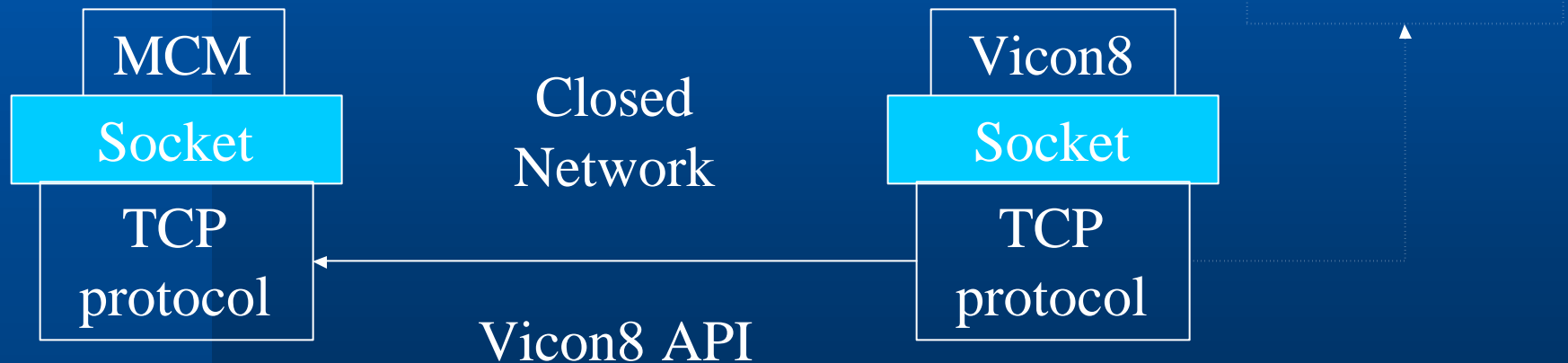
- Vicon8 motion data
- Real-Time Engine
- MCM

Interface between Application and Transport Layer using TCP

Interface is called a Socket

Socket Programming

- ✍ **Vicon8 is a proprietary client/server application**
- ✍ **Uses port 800**



Socket Programming (2)

✍ **C/C++**

✍ **Grab Motion Data via Function calls to the Vicon8 API**

✍ **Parse the data and send it to the translator**

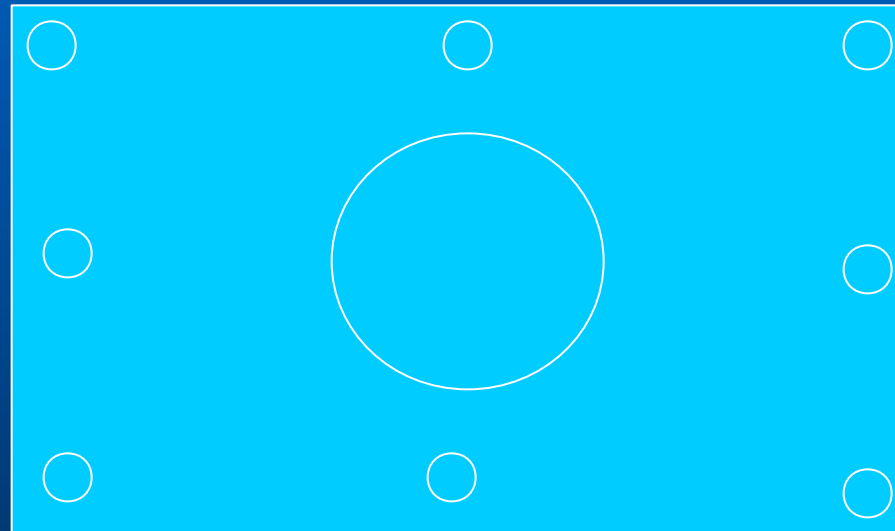
✍ **Translator will convert to MIDI command based on mapping**

Camera System Interface

- ✍ **Vicon Supplied SDK**
- ✍ **Motion Data Packets (TCP/IP)**

Physical Room Layout

Cameras, Capture Area



Music and Media Building

Second Floor, Motion Capture Studio

SDK

 Pending Vicon Contact

Specific Details and Design Aspects

- ✍ **Motion to MIDI**
- ✍ **C3D Data Format**
- ✍ **MIDI Format**

Motion to MIDI

- ✍ **Translation Issues**
- ✍ **What sort of motion?**
- ✍ **What MIDI commands?**

C3D Data Format

- ✍ **Coordinate 3D data**
- ✍ **Developed in 1987 by Dr. Andrew Dainis**
- ✍ **Used at the National Institutes of Health (Bethesda, MD)**
- ✍ **Biomechanics Labs**
- ✍ **Motion Capture Studios**

C3D Data Format (2)

Physical Measurements

- 3D coordinates (x, y, z)
- 16-bit Integers (or 32-bit floats)
- Analog data (eg. Force plate measurements)

Parameter Information

- Measurement units
- Data point labels (eg. 1 = left hand, 2 = right hand, 3 = right foot, etc)

C3D Data Format (3)

Format



512 Byte Header (Record 1 = 256 16-bit words)

1 or more Parameter records

1 or more Label and Range records (optional)



1 or more Data Records (3D and/or Analog data)

C3D Data Format (4)

- ✍ **Binary data**
- ✍ **Header contains pointers to the other sections**
- ✍ **Can jump straight to Data**

Ascii vs Binary

- ✍ **Ascii is easier to read (by human)**
- ✍ **Can be manipulated by text editor**
- ✍ **Inefficient for storage and access**
- ✍ **Generally accessed sequentially**
- ✍ **Inefficient if they must be read non-sequentially**

Ascii vs Binary (2)

- ✍ Binary files can be stored efficiently
- ✍ “Reader” program must be written or bought to interpret data
- ✍ MCM will use Vicon8 API to read data

C3D Header Record

Word	Typical Value	Description
1	0x5002 hex	Byte 1: The number of the first parameter record(typically 2) Byte 2: 50 hex indicates a C3D file
2	-	Number of 3D points stored in file
4	1	Number of first sample of 3D data (typically 1)
5	-	Number of lasts sample of 3D data
9	-	DATA_START – the record number for the start of the data

C3D Parameter Record

Byte	Typical Value	Description
3	-	Number of parameter records to follow
4	85	83 decimal + processor type (2 = PC-DOS machines) (for Integer/Real formats)

C3D Parameter Record (2)

- ✍ After header, parameter data is stored contiguously
- ✍ Parameters are organized into groups with a unique ID
- ✍ Eg. Point Group can have a Description, Label,
 - Units, Scale Parameters
- ✍ In addition to standard ones, many are user-define and application specific

C3D Data Record

3D Data for Field 1
Analog Data for Field 1
3D Data for Field 2
Analog Data for Field 2
...
...
3D Data for Field n
Analog Data for Field n

Identification of points is done in Parameter section

Data Points

Word	Description
1	Scaled X coordinate
2	Scaled Y coordinate
3	Scaled Z coordinate
4	cameras that measured point (1 bit per camera) -1 if not valid, ie, not seen by at least 2 cameras

Data Points (2)

- ✍ **x, y, z coordinates**
- ✍ **Camera which captured point**
- ✍ **Eg. 01111001**
- ✍ **Stored sequentially by frames**
- ✍ **Within frame, stored sequentially by point number**
- ✍ **Scaling done to convert Integer measurement to an accurate real number point in space based on a calibration volume**

MIDI Format

 **Musical Instrument Digital Interface**