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# NdnSIM Getting Start

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# Content

- NS3
  - compile
  - LOG
  - Schedule
  - Names
  - Basic Structure
- ndnSim



# 1.1 NS3 overview

- Network Simulator
- Doxygen: Documentation Generator
- Mercurial: code maintain
- Waf: build system
- Website:
  - [Www.nsnam.org](http://www.nsnam.org)
  - [Www.selenic.com/mercurial](http://www.selenic.com/mercurial)
  - [Code.google.com/p/waf](http://Code.google.com/p/waf)



## 1.2 compile

- `./waf configure -d debug -enable-examples -enable-tests`
- `./waf`
- `./waf --doxygen`



## 1.3 NS\_LOG

- Environment variable: NS\_LOG
  - NS\_LOG\_ERROR
  - NS\_LOG\_WARN
  - NS\_LOG\_DEBUG
  - NS\_LOG\_INFO
  - NS\_LOG\_FUNCTION
  - NS\_LOG\_LOGIC
  - NS\_LOG\_ALL



## 1.3.1 NS\_LOG examples

- In coding
  - `NS_LOG_COMPONENT_DEFINE("MyLog");`
  - `NS_LOG_DEBUG("xxx");`
- Environment Variable
  - `NS_LOG="MyLog=level_all|prefix_func"`
- I use:
  - `NS_LOG="*=level_all|prefix_func|prefix_time"`



# 1.4 Ns3::Simulator

- Simulator::Stop(Time)
- Simulator::Run()
- Simulator::Destroy()
- Simulator::Now()
- Simulator::Schedule()



# 1.4.1 Simulator::Schedule

- Schedule(Time, void(\*f), T1, T2)
  - \*f: function name
- Schedule(Time, MEM, OBJ, T1 [, T2 .. ])
  - Time:
  - MEM: &func
  - OBJ: this
  - T[12345]: param





# 1.5 Names

- `Ns3::Names`
  - `::Add(std::string name, Ptr<Object> object)`
  - `::Find(std::string) ---> Ptr<T>`
  - `::FindName(Ptr<Object>) ---> std::string`



# 1.6 Basic Structure

- Node
  - GetId()
  - GetObject()
- NodeContainer
  - Iterator
  - Begin
  - End
  - GetN
  - Get(index)
  - Add(): para ---> NodeContainer, Node, std::string



## 2. ndnSIM

- Config && Init && Stack
- FIB
- PIT(no reference)
- Interest
- Data
- App
- Start



## 2.1 Config && Init && Stack

```
Config::SetDefault("ns3::PointToPointNetDevice::DataRate",StringValue("1Mbps"));  
Config::SetDefault("ns3::PointToPointChannel::Delay", StringValue("10ms"));  
Config::SetDefault("ns3::DropTailQueue::MaxPackets",StringValue("20"));
```

```
/* topology */  
AnnotatedTopologyReader topologyReader("topo.txt", 25);  
topologyReader.SetFileName("topo/topo.txt");  
topologyReader.Read();
```

```
/* NDN stack */  
ns3::StackHelper ns3StackHelper;  
ns3StackHelper.SetContentStore("ns3::ns3::cs::Fifo", "MaxSize", "10000");  
ns3StackHelper.SetForwardingStrategy("ns3::ns3::fw::BestRoute");  
ns3StackHelper.InstallAll();
```

CS: FIFO, LRU, RANDOM, Stats::LRU, Freshness::LRU  
Forwarding Strategy: BestRoute, Flooding, SmartFlooding

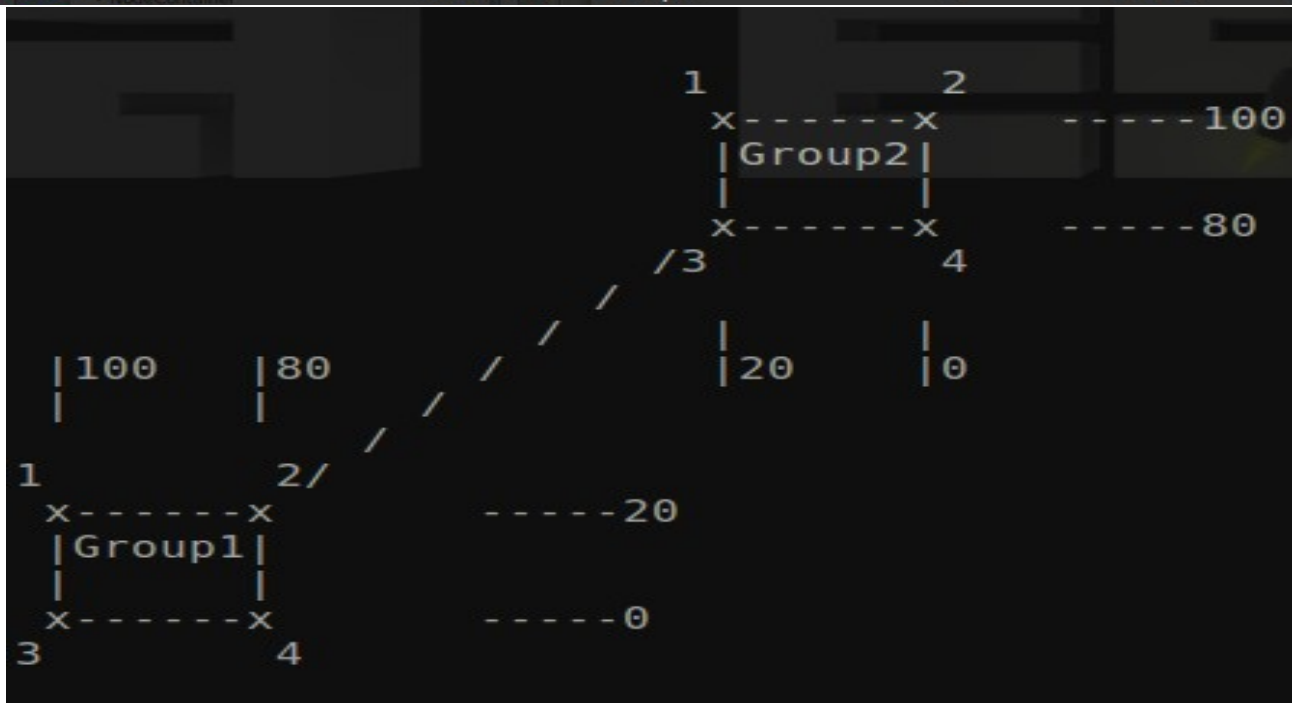
# 2.1.1 TopoReader



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```

39 router
40
41 #node      comment  yPos  x  xPos图 | 大纲视图 | 备注 | 讲义视图 | 幻灯片浏览 |
42 Node11     NA       20    100
43 Node12     NA       20    80
44 Node13     NA       0     100
45 Node14     NA       0     80
46 Node21     NA       100   20
47 Node22     NA       100   0
48 Node23     NA       80    20
49 Node24     NA       80    0
50
51 link
52   Simulator::Schedule
53 # bandwidth: link bandwidth NodeContainer
54 # metric: routing metric
55 # delay: link delay
56 # queue: MaxPackets for transmission queue on the link (both directions)
57
58 #srcNode      dstNode  bandwidth      metric  delay  queue
59 Node11        Node12    1Mbps          1      10ms   10
60 Node11        Node13    1Mbps          1      10ms   10
61 Node14        Node12    1Mbps          1      10ms   10
62 Node14        Node13    1Mbps          1      10ms   10
    
```







## 2.2 FIB(routing)

```
/* routing configure */ message-container.cc.1.0 build/extensions/m
undn::GlobalRoutingHelpers routingHelper; cc.1.0 build/extensions/user
routingHelper.InstallAll();
for (int i=0; i< chatterNodes.GetN(); i++) { ld/extensions/chat-app.cc.
cc.1.0 build/extensions/me
gixml.cc routingHelper.AddOrigins("/"+Names::FindName(node), node);
routingHelper.AddOrigins("/broadcast/chatapp", node);
} program: build/scenarios/ndn-tree-tracers.cc.5.0 build/extensions/ch
undn::GlobalRoutingHelper::CalculateRoutes(); tainer.cc.1.0 build/ext
```

```
void ChatApp::Config() 372:68: warning: 'const uint8_t* ns3::Packet::PeekL
{declared at /usr/local/include/ns3-dev/ns3/packet.h:362} [-Wdeprecated-c
17] cxxpPtr<ndn::Fib> fib = GetNode()->GetObject<ndn::Fib>(); extensions/c
ions/cusPtr<ndn::Name> prefix = Create<ndn::Name>("/broadcast/chatapp"); x
ld/extensionfib->Add(*prefix, lm_face, d0); tensions/test-app.cc.1.0 build/exter
build/sprefix = Create<ndn::Name>("/"+m_name);
17] cxxpfib->Add(*prefix, nm_face, d0); imple-with-custom-app.cc.4.0 build/e
}ild/extensions/custom-app.cc.1.0 build/extensions/message-container.cc.1
cc.1.0 build/extensions/forwarder.cc.1.0 build/extensions/test-app.cc.1.0
```





## 2.4 Data

```
void ChatApp::SendData(std::string name, const std::string msg) {
    {7} cxx: extensions/chat-app.cc -> build/extensions/chat-app.cc:
    extension NS_LOG_DEBUG("Sending data for %s", name);
    ns3::Ptr<Packet> packet = Create<Packet>(msg);
    extension Ptr<ndn::Data> data = Create<ndn::Data>(packet);
    (declared data->SetName(Create<ndn::Name>(name)));
    extension m_transmittedData(data, this, m_face);
    ns3::m_face->ReceiveData(data);
} extensions/chat-app.cc:372:68: warning: 'const uint8_t*' ns3::Packe
```

```
int size = contentObject->GetPayload()->GetSize();
const unsigned char *data = contentObject->GetPayload()->PeekData();
std::string msg(reinterpret_cast<const char*>(data), size); app.cc:1
```

- \* ns3::ndn::Data
  - SetName(Ptr<Name>)
  - SetName(const Name &)
  - GetName()
  - GetPayload()





## 2.5 Application

```
class ChatApp: public ndn::App -> build/extensions/chat-app.cc
{
public:
    static TypeId GetTypeId();
    void StartApplication();
    void StopApplication();
    void OnInterest(Ptr<const ndn::Interest> interest);
    void OnData(Ptr<const ndn::Data> contentObject);
};
```

```
/* create app */
void ns3::ChatApp::ProcessAnyServerData(const ns3::Ptr<ndn::AppHelper> appHelper("ChatApp"));
ns3::Time rand(time(NULL));
for(int i=0; i<chatterNodes.GetN(); i++) {
    chatterNodes.Get(i).Start(Seconds(5*(double)rand()/RAND_MAX));
}
} // namespace ns3
```



## 2.6 Start Simulation

```
g/*simulatoraction*/  
Simulator::Stop(Seconds(20.0));  
pndn::L3AggregateTracer::InstallAll("aggregate-trace.txt",Seconds(1.0));p  
undn::L3RateTracer::InstallAll("rate-trace.txt",Seconds(1.0));d/extensions  
eSimulator::Run();.1.0 build/extensions/test-app.cc.1.0 build/extensions/us  
/Simulator::Destroy();
```



# As for me

- Skeleton
  - Message
  - MessagContainer
  - ChatApp
  - Main
- Simulation



# Message

```
class Message {
public:
    void SetContent(const std::string& content);
    void AddLabel(const std::string& name, time_t theTime);
    const std::string& GetContent() const;
    time_t GetTime(const std::string& name) const;
    const std::map<std::string, time_t> GetMap() const;
    std::string ToXML() const;
private:
    std::string m_content;
    std::map<std::string, time_t> m_label;
};
```





# MessageContainer

```
class MessageContainer In member function 'void ns3::ChatApp::Pro
{ns3::ndn::Data>, bool)':
public: ns/chat-app.cc:345:68: warning: 'const uint8_t* ns3::Pac
(declare bool Add(Message msg); e/ns3-dev/ns3/packet.h:362) [-Wdepr
extension Message GetMessage(int index); ion 'void ns3::ChatApp::Pro
const ns3::std::string& GetLatestLabels(std::string name);
extension std::string GetLatestLabels(); 'const uint8_t* ns3::Pac
(declare size_t Size(); l/include/ns3-dev/ns3/packet.h:362) [-Wdepr
[17] cxxpr void AddIndex(std::string name, int index); 6.0 build/exte
sions/cus std::vector<int> GetIndexVector(std::string); iner.cc.1.0
ld/exten int GetIndexNewerThan(std::string name, time_t theTime); i
+ build/ss std::string ToXMLAfterIndex(int index);
private: rogram: build/scenarios/ndn-simple-with-custom-app.cc.4.0
build/ext std::vector<Message> cm_messages; extensions/message-contai
e.cc.1.0 /* build/extensions/pugixml.cc.1.0 build/extensions/test-app
er.cc.1.0 *> name <--> index vector custom-app
[17] cxxpr */ ram: build/scenarios/myfirst.cc.3.0 build/extensions/c
stom-app. std::map<std::string, std::vector<int> n> rm_record; build/ex
sions/pugixml.cc.1.0 build/extensions/test-app.cc.1.0 build/exten
n}; // MessageContainer
```



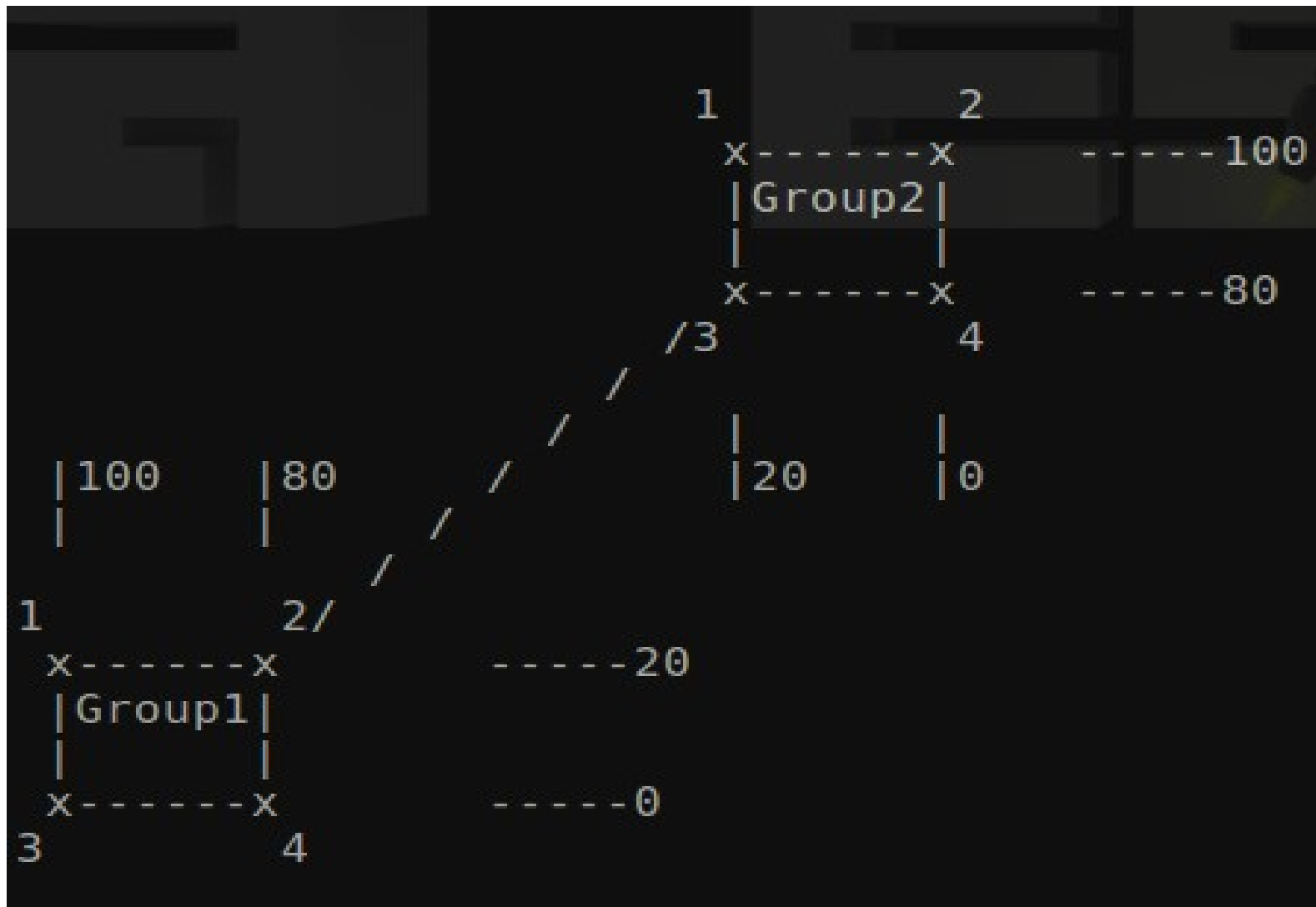


# ChatApp

```
70class ChatApp: public ndn::App { NS3_PROPAGATION=1, '-DHAVE_NS3_SPECTRUM=1', '-DH
8{DHAVE_NS3_TAP_BRIDGE=1, '-DHAVE_NS3_TOPOLOGY_READ=1', '-DHAVE_NS3_UAN=1', '-DHA
9public: 1, '-DHAVE_NS3_WIFI=1', '-DHAVE_NS3_WIMAX=1', '-DNS3_LOG_ENABLE=1', '-DNS
10, '../extstaticsTypeId GetTypeId(); '-o', 'extensions/chat-app.cc.1.o']
11@PC:test void StartApplication();
12: Enterin void StopApplication(); /Documents/GitHub/ndn/ndnSIM/lihebi/test/build'
13/17] cxx: void OnInterest(Ptr<const> ndn::Interest> ointerest); p.cc.1.o
14extension void OnData(Ptr<const> ndn::Data> ncontentObject); tApp::ProcessReceivedMess
15private: n::Data>, bool):
16extension void ServerSelectPeriod(); ing: 'const uint8_t* ns3::Packet::PeekData() co
17 (declare void GenMessagePeriod(); ns3-dev/ns3/packet.h:362) [-Wdeprecated-declarati
18extension void AnythingNewInterestPeriod(); 'void ns3::ChatApp::ProcessAnyServerDat
19const ns3::ndn::Data>&):
20extension void Config(); 372:68: warning: 'const uint8_t* ns3::Packet::PeekData() co
21 (declare void Init(); cal/include/ns3-dev/ns3/packet.h:362) [-Wdeprecated-declarati
22/17] cxxprogram: build/scenarios/simple-test-app.cc.6.o build/extensions/chat-app.
23sions/cus void ProcessAllPendingInterests(); ssage-container.cc.1.o build/extensions
24ild/exten bools ProcessPendingInterest(Ptr<const> ndn::Interest> ointerest); ensions/us
25> build/s void ProcessGiveMeInterest(Ptr<const> ndn::Interest> interest, int index);
26/17] cxxprogram: build/scenarios/ndn-simple-with-custom-app.cc.4.o build/extension
27build/ext void ProcessAnyServerData(const Ptr<const> ndn::Data> o&contentObject); build
28e.cc.1.o void ProcessReceivedMessages(const Ptr<const> ndn::Data> pcontentObject; /bo
ademethingnew); build/ndn-simple-with-custom-app
29/17] cxxprogram: build/scenarios/myfirst.cc.3.o build/extensions/chat-app.cc.1.o b
30stom-app. void SendInterest(std::string name); ainer.cc.1.o build/extensions/message
31nsions/pu void SendAnythingNewInterest(); est-app.cc.1.o build/extensions/user-reade
32myfirst void SendSomethingNewInterest(int index);
33/17] cxxp void SendGiveMeInterest(std::string clientName; estd::string index); 1.o bu
34tom-app.cc.1.o build/extensions/message-container.cc.1.o build/extensions/message.
35sions/pug void SendData(std::string name; sconst std::string msg); nsions/user-reader
36ihebi void GenMessage();
37/17] cxxp bool UpdateLocal(Message& msg); e-tracers.cc.5.o build/extensions/chat-app
38nsions/custom-app.cc.1.o build/extensions/message-container.cc.1.o build/extension
39uild/exte virtual void SplitString(std::string& name; - char cindent); ild/extensions/u
```



# Simulation







# Server, anything new

```
01730515s 7 ChatApp:StartApplication(): 0.730515
21143s 5 ChatApp:StartApplication():n2.143me_t> label = msg.GetMap();
2173052s 7 ChatApp:GenMessage():tGened message: I'm Node24 at Sun Dec 15 23:16:14 2013 iter!=_la
2.99555s 7 ChatApp:GenMessage(): Gened message: I'm Node24 at Sun Dec 15 23:16:14 2013
311103s 5 ChatApp:SendInterest():- Sending Interest packet for /broadcast/chatapp/anyserver/0
3112073s 7 ChatApp:OnInterest(): Received Interest packet for /broadcast/chatapp/anyserver/0
3112073s 7 ChatApp:OnInterest(): Level: 0 My Level: 1
3112073s 7 ChatApp:SendData(): Sending data for /broadcast/chatapp/anyserver/0
3113126s 5 ChatApp:OnData(): Receiving Data packet for /broadcast/chatapp/anyserver/0
3113126s 5 ChatApp:OnData(): DATA received for name /broadcast/chatapp/anyserver/0
3113126s 5 ChatApp:ProcessAnyServerData(): My server changed to Node24
31143s 5 ChatApp:SendInterest(): Sending Interest packet for /Node24/chatapp/anythingnew
311534s 7 ChatApp:OnInterest():nReceived Interest packet for /Node24/chatapp/anythingnew
/Node24/chatapp/anythingnew
311534s 7 ChatApp:SendData(): Sending data for /Node24/chatapp/anythingnew
3116411s 5 ChatApp:OnData():tReceiving Data packet for /Node24/chatapp/anythingnew
3116411s 5 ChatApp:OnData():gDATA received for name /Node24/chatapp/anythingnew
3136179s 7 ChatApp:GenMessage(): Gened message: I'm Node24 at Sun Dec 15 23:16:14 2013
3147329s 0 ChatApp:StartApplication():a3:47329els(std::string name)
3166602s 7 ChatApp:SendInterest(): Sending Interest packet for /broadcast/chatapp/anyserver/0
3166602s 7 ChatApp:OnData():dReceiving Data packetdfor /broadcast/chatapp/anyserver/0
3166602s 7 ChatApp:OnData():tDATA receivedefordnamee/broadcast/chatapp/anyserver/0
3166602s 7 ChatApp:ProcessAnyServerData(): My server changed to Node24
```





# Something new

```
6?04418s 5 ChatApp:GenMessage(): Gened message: I'm Node22 at Sun Dec 15 23:16:14 2013
6?04418s 5 ChatApp:SendInterest(): Sending Interest packet for /Node24/chatapp/somethingnew/Node22/5
6?05467s 7 ChatApp:OnInterest(): Received Interest packet for /Node24/chatapp/somethingnew/Node22/5
6?05467s 7 ChatApp:SendInterest(): Sending Interest packet for /Node22/chatapp/giveme/5
6?06506s 5 ChatApp:OnInterest(): Received Interest packet for /Node22/chatapp/giveme/5
6?06506s 5 ChatApp:SendData(): Sending data for /Node22/chatapp/giveme/5
6?07575s 7 ChatApp:OnData(): Receiving Data packet for /Node22/chatapp/giveme/5
6?07575s 7 ChatApp:OnData(): DATA received for name /Node22/chatapp/giveme/5
```