EXata学习(01):基础篇

目标:熟悉基本使用 版本: EXata5.1 参考资料: Exata 4.x 中文教程 提前学习: (1) EXata-5.1-ProductTour.pdf (2) 查阅 EXata-5.1-UsersGuide.pdf

一、第2章 实验

- 1. 启动程序 exata5.1;
- 2. 创建一个新场景,命名为lab2,存在F:\ex;在scenario properties中可修改画布大小。
- 3. 添加两个节点: default device类型;
- 4. 在两个节点间添加cbr application: 先点击Application中的 CBR, 再左键分别点击起始节点和终止节点;
- 5. 添加大量随机节点:菜单"Tools"-->"node placement". 添加32个节点;添加三个CBR业务: 1-->2, 21-->25,5-->20
- 6. 点击"Run simulation", 生成模拟文件
- 7. 点击play,运行动画;有两种模式可用: simulation和Emulation。后者是真实速度, simulation是模拟速度,可能更快。两种模式下,仍可以在播放前调整动画速度。



8. 运行完可以通过Analyzer分析运行结果,包括Application, Transport, Network, MAC, Phy各层统计量;

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9. 点击Architect可以重新返回架构视图

Ir Architect

- 10. 点击"Switch to design mode", 返回设计模式, 如果需要重新进行场景修订
- 1
- 11. 可以显示天线方向图:点击view-->display setting-->antenna pattern



12. 单步模式设置: 菜单Animation-->step setting, 设置步长为100个命令,

Step Command Inte	?	\times	
Set Command Interval	100	•	
ОК	Cancel		

13. 不断点击step mode以单步运行;注意多次点击,Output窗口中完成比例的变化。

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14. 动态统计功能:回到design mode,点击Run simulation;在Play之前,菜单Animation-->Dynamic Statistics,勾选 IP: Number of Packets Received

ov Scenano Dynamic Statistics	3 <u>x</u>
P. Number of Packets Received	Aqq equite v
IP: Number of Fackets Received with Errors in F Header Dattery Model: Dattery Charge (mAhr)	Per Node v
Update Interval Time	100 🐳 Mileeconds 🔻
	Crintel

15. 练习: F:\lab2\ex60.config

二、第3章 Qualnet基本应用

- 1. 练习实验 3A
 - a. 应用"Lookup"功能:一种抽象的、不可靠的Query/Response业务模型,类似DNS, PING。
 - b. 启动时间、持续时间改为 5s、10s; 原为5min、10min
 - c. 问题: 1--->8的 Lookup, 但 1 并没有发出包? 主要是7-8之间的包?
- 2. 练习实验3B: packet tracing
 - a. Warning: Error Log 窗口提示"EXata interface not found. Packet Sniffer disabled."需要打开 Sniffer开关。采包节点周围会多一个三角形阴影:



00 1									
	-1000	-500)		500		 1000	
			-						
					*				
			-						
			-				CBR+		

b. Enable packet Tracing: 可以追踪每个packet 在协议栈中的路径,启动追踪后,运行后会生成要给*.trace文件,与*.config并列。设置方法:

Scenario Properties (3b.conf	ig)	? >
General Terrain Channel	Properties Mobility Cyber Statistics and Traci	ng 📔 Supplemental Files 📔 Externa 💶 🕨 Help
File Statistics	Packet	: Tracing
Statistics Database	Property	Value
	[-] Enable Packet Tracing	Yes 💌 🔳
	[-] Trace All Layers	Yes 🗨 🔳
	Trace All Application Layer Protocols	Yes 🔻
	Trace All Transport Layer Protocols	Yes 🔻
	Trace All Network Layer Protocols	Yes 🔻
	Trace Direction	Both
	Trace Included Headers	None
	Enable Access List Tracing	No

C. 点击"Packet Tracer"按钮。进入packet tracing视图, Open相应的trace文件,即可以查看packet传输过程 中的每个协议层次的每个动作事件,可以逐个查看:

Architect 📊 Analyzer 🖃 Packet Tracer	File Editor									
◆ ▲ ▶ ₭ ₦										
exata_Nov_03_22_20_55_06.trace										
	Index	/ ту	pe Mark	Tracing Node	fracing Protoco	imulation Time	riginating Nod	4essage Sequence Number	Originating Protocol	Action Type
	1			1	CBR	0	1	0	CBR	SEND
	2			1	UDP	0	1	0	CBR	SEND
	3			1	IPv4	0	1	0	CBR	SEND
	4			1	IPv4	0	1	0	CBR	ENQUEUE
	5			1	IPv4	0	1	0	CBR	DEQUEUE
	6	2		1	BELLMANFORD	0	1	1	BELLMANFORD	SEND
	7	2		2	BELLMANFORD	0	2	0	BELLMANFORD	SEND
	8			2	IPv4	0	1	0	CBR	RECV
	9			2	UDP	0	1	0	CBR	RECV
	10			2	CBR	0	1	0	CBR	RECV
	11	2		2	UDP	0	2	0	BELLMANFORD	SEND
	12	2		2	IPv4	0	2	0	BELLMANFORD	SEND
	13	2		2	IPv4	0	2	0	BELLMANFORD	ENQUEUE
	14	₿2		2	IPv4	0	2	0	BELLMANFORD	DEQUEUE
	15	2		1	IPv4	0	2	0	BELLMANFORD	RECV
	16	2		1	UDP	0	2	0	BELLMANFORD	RECV
	17	2		1	BELLMANFORD	0	2	0	BELLMANFORD	RECV
	18	2		1	UDP	0	1	1	BELLMANFORD	SEND
	10	172			TDud	0	4	4	RELIMANEORD	CEND

3. 练习实验3C:无线链路

- a. 设置无线链路属性:
 - i. Scenario Properties-->Channel Properties-->Number of Channels ... ==>Array Editor: channel 0 General Properties: 选择channel frequency: 2.4GHz; Pathloss model: free space

Property Value Number of Channels 1 Array Editor ? Number of Channels: 1 Properties Index 0 : channel0 General General Image: Channel0 General Image: Channel0 Channel Name Channel0 Channel Name Channel0 Channel Frequency 2.4 Pathloss Model Free Space [-] Shadowing Mean (dB) 4.0 Fading Model None Signal Propagation Speed (m/s) 3e8 Propagation Communication Prox 400 Propagation Profile Update Ratio 0.0		Cl	nannel Properties		_
Number of Channels 1 Array Editor ? Number of Channels: 1 Properties Index 0 : channel0 General General Properties Property Value Channel0 Channel0 Channel Name channel0 Channel Frequency 2.4 Pathloss Model Free Space [-] Shadowing Meal Constant Shadowing Meal Constant Signal Propagation Speed (m/s) 3e8 Propagation Communication Prox 400 Propagation Profile Update Ratio 0.0		Property	Value		
Array Editor ? Number of Channels: 1 Properties Index 0 : channel0 General General Properties Channel Name Channel0 Channel Name Channel0 Channel Frequency 2.4 Pathloss Model Free Space Image: Space Image: Space Shadowing Mean (dB) 4.0 Pading Model None Enable Inter-channel Interfernce No Signal Propagation Speed (m/s) 3e8 Propagation Communication Prox 400 Propagation Distance 0 Propagation Profile Update Ratio 0.0	Number of Channels		1		
Number of Channels: 1 Properties Index 0 : channel0 Image: Channel of the second s		Array Editor			?
Index 0 : channel0 General Property Value Channel Name Channel0 Channel Frequency 2.4 GHz Pathloss Model Free Space [-] Shadowing Mean (dB) 4.0 Fading Model None Signal Propagation Speed (m/s) 3e8 Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Profile Update Ratio 0.0		Number of Channels: 1	Proj	perties	
General Properties Property Value Channel Name Channel0 Channel Frequency 2.4 GHz Pathloss Model Free Space [-] Shadowing Model Constant Shadowing Mean (dB) 4.0 Fading Model None Enable Inter-channel Interfernce No Signal Propagation Speed (m/s) 3e8 Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Profile Update Ratio 0.0		+ Index 0 : channel0	General		🚇 He
Property Value Channel Name Channel0 Channel Frequency 2.4 GHz Pathloss Model Free Space Pathloss Model Constant Constant Shadowing Mean (dB) 4.0 Fading Model None Enable Inter-channel Interfernce No Signal Propagation Speed (m/s) 3e8 Propagation Communication Pros 400 Propagation Profile Update Ratio 0.0		∎ e	General	Properties	
Channel Name Channel0 Channel Frequency 2.4 Pathloss Model Free Space Pathloss Model Constant [-] Shadowing Mean (dB) 4.0 Fading Model None Enable Inter-channel Interfernce No None Signal Propagation Speed (m/s) Signal Propagation Distance 0 Propagation Distance 0 Propagation Profile Update Ratio 0.0			Property	Value	
Channel Frequency 2.4 GHz Pathloss Model Free Space Pathloss Model Constant Shadowing Mean (dB) 4.0 Fading Model None Fading Model None Signal Propagation Speed (m/s) 3e8 Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Distance 0 Propagation Profile Update Ratio 0.0			Channel Name	channel0	
Pathloss Model Free Space [-] Shadowing Model Constant Shadowing Mean (dB) 4.0 Fading Model None Fading Model None Signal Propagation Speed (m/s) 3e8 Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Profile Update Ratio 0.0			Channel Frequency	2.4 GHz	-
[-] Shadowing Model Constant Shadowing Mean (dB) 4.0 Fading Model None Enable Inter-channel Interfernce No Signal Propagation Speed (m/s) 3e8 Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Communication Prox 400 Propagation Profile Update Ratio 0.0			Pathloss Model	Free Space	- 4
Shadowing Mean (dB) 4.0 Fading Model None Enable Inter-channel Interfernce No Signal Propagation Speed (m/s) 3e8 Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Communication Prox 400 Propagation Profile Update Ratio 0.0			[-] Shadowing Model	Constant	-
Fading Model None Enable Inter-channel Interfernce No Signal Propagation Speed (m/s) 3e8 Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Communication Pros 400 Propagation Profile Update Ratio 0.0			Shadowing Mean (dB)	4.0	
Enable Inter-channel Interfernce No Signal Propagation Speed (m/s) 3e8 Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Communication Prox 400 Propagation Profile Update Ratio 0.0			Fading Model	None	-
Signal Propagation Speed (m/s) 3e8 Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Communication Prox 400 Propagation Profile Update Ratio 0.0			Enable Inter-channel Interfernce	No	-
Propagation Limit (dBm) -111.0 Maximum Propagation Distance 0 Propagation Communication Prox 400 Propagation Profile Update Ratio 0.0			Signal Propagation Speed (m/s)	3e8	
Maximum Propagation Distance 0 Propagation Communication Prox 400 Propagation Profile Update Ratio 0.0			Propagation Limit (dBm)	-111.0	
Propagation Communication Prox 400 Propagation Profile Update Ratio 0.0			Maximum Propagation Distance	0	
Propagation Profile Update Ratio 0.0			Propagation Communication Prox	. 400	
			Propagation Profile Update Ratio	0.0	

ii. 可以用单步模式观看包收发过程:

iii. 修改Wireless subnet properties: 打开方法:双击Table View中的 Network Tab页中的 wireless subnet行。修改不同速率下的发射功率11, 12, 15, 20 dBm (Case #2), 默认均为15 dBm (Case #1)。对比两种设置下CBR Client和 CBR Server收发message和Data大小:

- 1. Case #1: CBR Client: 发送 24 messages, 12 288 bytes; CBR server: 接收 10 messages, 5120 bytes
- 2. Case #2: CBR Client: 发送 24 messages, 12 288 bytes; CBR server: 接收 24 messages, 12288 bytes

<mark>3.</mark> 结论:	Case #1 收到的数据不足 Case #	‡2 的一半。	【链路速率为 2Mbps】
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-1000	Wireless Subnet Properties (Default Wireless Subnet		7 X	1500 2000
1500	General Physical Layer MAC Layer Network	Layer Routing Protocol Router Properties File Statisti	cs Help	
		Physical Layer	<u> </u>	
-	Property	Value		
	Listenable Channels	channel0		
1	Listening Channels	channel0		
-	[-] Radio Type	802.11b Radio	•	
	[-] Enable Auto Rate Fallback	No	•	
	Data Rate	2	Mbps 💌	
1000	Transmission Power at 1 Mbps (dBm)	11.0	<u> </u>	
	Transmission Power at 2 Mbps (dBm)	12.0	4	
1	Transmission Power at 6 Mbps (dBm)	15.0		
-	Transmission Power at 11 Mbps (dBm)	20.0	4	
	Receive Sensitivity at 1 Mbps (dBm)	-94.0		
1	Receive Sensitivity at 2 Mbps (dBm)	-91.0		
-	Receive Sensitivity at 6 Mbps (dBm)	-87.0		
500	Receive Sensitivity at 11 Mbps (dBm)	-83.0		
	Estimated Directional Antenna Gain (dB)	15.0		
-	Packet Reception Model	PHY802.11b Reception Model	-	
	[-] Specify Antenna Model from File	No	•	
-	Antenna Model	Omnidirectional	•	
-	Antenna Gain (dB)	0.0		
	Antenna Height (meters)	1.5		
	, Find	Apply OK Cano	el Add To Batch	X: 750.00 🛨 Y: 750.00
Nodes Groups	Interfaces Networks Applications Hierarchies			
	Network Address	Туре		Member Nodes
169.0.0.0		Default Wireless Subnet		{1 thru 7}

iv. 修改接收灵敏度:将速率为 1, 2, 6, 11Mbps下的接收功率由默认的–94, –91, –87, –83dBm分别提 高到: –77, –78, –81, –83 dBm, 结果一个包都没收到!

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三、第4章 教程A: Qualnet高级应用(有线网络)

1. Lab4A-1: 瓶颈网络

a. 查看IP地址、interface等:菜单View--》Display Setting,选择激活IP Address, Interface Name;IP地址等 (包括下面的Queue)。Interface属性可以双击节点进行配置。



b. 在文本编辑器中打开场景文件(在design mode下已打开场景):查看通用及协议栈配置信息



- **C**. 问题:<mark>文本编辑器默认没有语法高亮</mark>,如何激活此功能?
- d. 加载Application cbr,场景目录中会增加Lab4A–1.app,中间配置业务参数。<mark>问题:为什么Transport</mark> Protocol没发现UDP协议?
- e. 编辑静态路由文件:外部创建一个文本文件lab4a-1.routes-static,用EXata的文本编辑器打开,注意文件列表需要refresh一下才能看到新的文件,选择"edit as text file"
- f. 设定采用静态路由:在Table View窗口点 Networks Tab页,双击链路,可查看修改协议。
- g. 查看Queues: View--》Display Setting中激活Queues,可以查看队列溢出造成的丢包。可以修改两个cbr 业务的发包interval,查看节点1和2队列的丢包情况。interval为 1ms时,只有瓶颈节点 3 丢包; interval为 0.1 ms时,节点1和2都会发生丢包。



h. 可以在Analyzer中分析packet级别的统计结果:比如在 CBR业务层,分别从client和server端查看发送和接 收的消息(messages)数和字节数,也可以在网络层查看IP包的收发及丢包的统计结果。下图是由于队列溢 出造成的丢包数统计:



- 2. LAB4A-2: 组播实验
 - a. 创建一个树状拓扑场景



b. 【问题】如何一次设置多个链路的属性? 【回答】在Table View中Network Tab页,选中多条链路,右键选 Properties可以同时设置多条链路。

C. 激活组播路由:按b的方法,关闭单播路由(None),并激活所有链路的组播路由:【组播背景知识:只有组播接收方向路由器发出请求后,网络路由器才复制一份数据给接收方,从而节省接收方的带宽。而广播方式无论接收方是否需要,网络设备都将所有广播信息向所有设备发送,从而大量占据接收方的接入带宽。组播没有补包机制,因此是不可靠的。组播协议包括组管理协议(IGMP)和组播路由协议(比如DVMRP】PIM-DM、MOSPF等);主机使用IGMP通知子网组播路由器加入或退出组播组;路由器使用IGMP查询本地子网是否有属于某个组播组的主机。组播路由器能够将组播包发给各个组播成员,要依赖组播路由协议。】

	Properties						- 🖾 H
General				R	outing Protocol		
Network Protocol Bouting Protocol	col col		Pro	perty		Value	
ARP		Routing Prot	ocol IPv4		None		•
Background Tra	affic	Enable IP Fo	rwarding		Yes		
		Specify Stat	ic Routes		No		
		Specify Defa	ult Routes		No		
		[-] Enable Multi	cast		Yes		• 6
		[-] Group Ma	inagement F	Protocol	IGMP		•
		Route	r List		0		
		Unsoli	cited Report	t Count	2		
		Specify S	tatic Multica	st Routes	No		
		Multicast	Protocol		DVMRP		• (
		Configure De	efault Gatev	vay	No		
		Enable HSRF	Protocol		No		
Find					Apply		d To P
			-(
	Nodes Gro	oups Interfaces	Network	s Applications	Hierarchies		
	Ne	etwork Address		Ту	pe	Member Nodes	
	190.0.5.0		l	.ink		{3, 6}	
	190.0.6.0		l	ink		{3, 7}	
	190.0.7.0		l	.ink		{4, 8}	
	190.0.8.0		l	.ink		{4, 9}	
				Link		{7, 10}	
	190.0.9.0		l	.ink		{7, 10}	

d. 配置组播路由器: 节点 4 和 7: 选择网络地址190.0.1.0的链路属性, 在router list 的花括号内输入4, 7

【???为什么不是选择节点4和7进行设置?】

General Network Protocol		Routing Protocol	
Routing Protocol	Property	Value	
ARP Background Traffic	Routing Protocol IPv4	None	
	Enable IP Forwarding	Yes	-
	Specify Static Routes	No	•
	Specify Default Routes	No	•
	[-] Enable Multicast	Yes 🗸	
	[-] Group Management Protocol	IGMP	
	Router List	{4, 7}	
	Unsolicited Report Count	2	
	Specify Static Multicast Routes	No	-
	Multicast Protocol	DVMRP -	
	Configure Default Gateway	No	-
	Enable HSRP Protocol	No	-

e. 定义组播组和组成员:菜单Tools--》Multicast Group Editor

Multicast Group Editor				? ×
IP Version IPv4 Multicast Address 224.000.001.000	port Multicast Group File			
Multicast Groups		• Nodes in Multicast Group		
224.000.001.000	Node ID Interface IGM Address Vers	IP Join Time Leave T	ime Filter Mode	Sources
	8 All Interfaces 2	0 seconds 30 second	s Select Filter M	
	10 All Interfaces 🔻 2	0 seconds 30 second	s Select Filter M	
	Change configuration	s of		
Clear All	group	ast	Apply OK	Cancel

f. 加载单节点应用 MCBR 业务,即组播CBR业务:左栏Toolset中"Single Host Applications"中选择MCBR, 然后点击Node 1,可以在MCBR Properties中修改组播属性;在 Table View中的 Application页中即可发现 MCBR业务



g. 配置 MCBR 业务:在 Table View---》Application 页双击 MCBR业务,打开属性框,进行配置

	General Properties	
Property	Value	
Source	1	
Multicast Group Address	224.0.1.0	
Items to Send	1000	J
Item Size (bytes)	512	
Interval	1 sec	onds
Start Time	1 sec	onds
End Time	5 minutes	; 🔹
] Priority	Precedence	•
Precedence Value	0	
Enable MDP	No	
Session Name	[Optional]	
Session Name	[Optional]	

四、高级应用(无线网络)

- 1. 实验4B-1: 多信道
 - a. 设置如图场景:两个无线子网,节点3共享两个子网。建立子网的方法很简单:把设备连接到子网,即加入该子网。【亦可参scenarios/demo/MultiChannel,一个三个无线子网对应三个不同频率信道的例子】



b. <mark>设置多信道</mark>: 子网1和子网2分别采用 2.4GHz和 2.5GHz。在Scenario Properties中的Channel Properties中 设置:

	Channel Properties		
Array Editor			? ×
lu Number of Channels: 2	Pro	perties	
Index 0 : channel Index 1 : channel	General		🕰 Help
	General	Properties	
	Property	Value	
	Channel Name	channel1	
	Channel Frequency	2.5 GHz	- 4
	Pathloss Model	Two Ray	-
	[-] Shadowing Model	Constant	-
	Shadowing Mean (dB)	4.0	
	Fading Model	None	•
	Enable Inter-channel Interfernce	No	-
	Signal Propagation Speed (m/s)	3e8	
	Propagation Limit (dBm)	-111.0	
	Maximum Propagation Distance	0	
	Propagation Communication Proximity	400	
	Propagation Profile Update Ratio	0.0	

c. 关于Listening和Listenable信道:前者代表从仿真开始就一直监听的信道,后者代表潜在的可监听的信道。 可以通过Networks页面点击不同的Subnet进行设置。默认两个子网都监听channel0.

d. 观察无线通信有效距离:调节节点1,3,5距离,查看CBR业务统计结果,主要结论:

i. 距离过大, CBR 消息不能全部收到。

ii. 两个子网采用两个信道channel 0 和 1, 同样距离下, 能接收到更多的messages。

2. 实验4B-2: 方向天线

- a. 三节点直线场景
- b. 配置天线模型: 【Azimuth:方向角】: 配置标准的天线模型,在Table View窗口点Network页双击wireless subnet,在Physical Layer设置表中:设定"Specify Antenna Model from File"为 NO;修改Antenna Model为"Switched Beam";在天线方向图文件(Antenna Azimuth Pattern File)中选择 "D:\Scalable\exata\5.1\scenarios\default"下的default.antenna-azimuth文件。如果用到特定的天线模型 文件,则设定"Specify Antenna Model from File"为 Yes,并指定用户自定义的模型文件。

Wireless Subnet Properties (Default Wireless Subnet 169.0.0.)	? >
General Physical Layer MAC Layer Network Layer Rou	iting Protocol Router Properties File Statistics 🔱 Heli
[-] Enable Auto Rate Fallback	No
Data Rate	2 Mbps 💌
Transmission Power at 1 Mbps (dBm)	15.0
Transmission Power at 2 Mbps (dBm)	15.0
Transmission Power at 6 Mbps (dBm)	15.0
Transmission Power at 11 Mbps (dBm)	15.0
Receive Sensitivity at 1 Mbps (dBm)	-94.0
Receive Sensitivity at 2 Mbps (dBm)	-91.0
Receive Sensitivity at 6 Mbps (dBm)	-87.0
Receive Sensitivity at 11 Mbps (dBm)	-83.0
Estimated Directional Antenna Gain (dB)	15.0
Packet Reception Model	PHY802.11b Reception Model
[-] Specify Antenna Model from File	No
[-] Antenna Model	Switched Beam
[-] Antenna Pattern Type	Traditional
Antenna Azimuth Pattern File	le/exata/5.1/scenarios/default/default.antenna-azimuth 🔳
Antenna Elevation Pattern File	[Optional]
Antenna Gain (dB)	0.0
Antenna Height (meters)	1.5
Antenna Efficiency	0.8
Antenna Mismatch Loss (dB)	0.3
Find	Apply OK Cancel Add To Batc

c. 设置MAC层:激活方向性天线模式:还在上个配置窗口,选择MAC Layer,设定"Enable Directional

Antenna Mode"为"Yes"

MAC	Layer
Property	Value
MAC Protocol	802.11
Short Packet Transmit Limit	7
Long Packet Transmit Limit	4
RTS Threshold (bytes)	0
Stop Receiving after Header Mode	No
[-] Station Association Type	None
Enable Power Save Mode	No
[-] Enable Directional Antenna Mode	Yes
Direction Cache Expiration Time	2 seconds 💌
NAV Delta Angle	37.0
Short Packet Limit	8
Security Protocol	None
Specify Network Security Parameters	No
MAC Propagation Delay	1 micro-seconds 💌
Enable Promiscuous Mode	No
Enable LLC	No

d. 查看天线Pattern: View-->Display Setting: 激活显示 Antenna Pattern, 运行:



e. 设定用户自定义的天线模式:1)首先加载天线模型文件:在场景属性-->Supplemental Files中添加辅助的模型文件(Exata提供了一些例子,在D:\Scalable\exata\5.1\data\antenna路径下)

Supple	mental Files	
Property	Value	
Antenna Models File	Scalable/exata/5.1/data/antenna/default.antenna-models	
Application Configuration File	F:/ex/Lab4B/4b-2/4b-2.app	
Human in the Loop Configuration File	[Optional]	
MDP Profile File	[Optional]	
Router Models File	[Optional]	
Link16/IP Gateway Configuration File	[Optional]	
GSM Node Configuration File	[Optional]	
Number of User Profile Files	0 .	
Number of Traffic Pattern Files	0	
Number of Arbitrary Distribution Files	0	
Multicast Group File	[Optional]	
BGP Config File	[Optional]	

f. 设定设定"Specify Antenna Model from Flle"为 Yes,并在模型文件列表中选择一个, e.g., "DEFAULT1-SWITCHED-BEAM"

eneral Physical Layer MAC Layer Networ	Layer Routing Pro	otocol	Router I	Properties	File Statistics	4	ФН
mansmission Power at 6 Mibbs (dBm)	15.0						_
Transmission Power at 11 Mbps (dBm)	15.0						
Receive Sensitivity at 1 Mbps (dBm)	-94.0						
Receive Sensitivity at 2 Mbps (dBm)	-91.0						
Receive Sensitivity at 6 Mbps (dBm)	-87.0						
Receive Sensitivity at 11 Mbps (dBm)	-83.0						
Estimated Directional Antenna Gain (dB)	15.0						
Packet Reception Model	PHY80)2.11b F	Reception	Model			-
-] Specify Antenna Model from File	Yes					-	
Antenna Model	DEFAU	LT1-SW	ITCHED-B	EAM			-
Antenna Gain (dB)	0.0						_
Antenna Height (meters)	1.5						_
Antenna Efficiency	0.8						_
Antenna Mismatch Loss (dB)	0.3						_
Antenna Cable Loss (dB)	0.0						
Antenna Connection Loss (dB)	0.2						_
Antenna Orientation Azimuth (degrees)	0						_
Antenna Orientation Elevation (degrees)	0						_
Temperature (K)	290.0						_
Noise Factor	10.0						_
Energy Model	None						

g. 重新运行。Run Simulation 出现错误【! ! 】提示LicenseCheckout 【没找到原因! ! !】



Attempting license checkout (should take less than 2 seconds) ...Error in file ..\kernel\src\fileio.cpp:397 Can't open input file default.antenna-azimuth

h. 还原到默认天线模型,Switched Beam,增加两个中继节点,重新运行。<mark>注意观察Beam角度</mark>。



i. 增加CBR发射速率到1/ms,显示队列,重新运行,发现节点1产生队列溢出;可以对比不同的路由协议下的传输 性能。



- j. 采用 steerable antenna model.【知识点:智能天线有两种类型:波束切换和可操纵的。A switched beam antenna can utilize multiple antenna patterns. A steerable antenna can rotate the antenna to achieve the maximum gain】
- k. Table View--》Networks,双击无线子网,在Physical Layer--》Antenna Model中选择Steerable,在 Antenna Azimuth Pattern File处选择steerable.antenna-azimuth,重新运行,观察天线pattern的变化,和丢 包情况。

neral Physical Layer MAC Layer Network Layer	Routing Protocol Router Properties File Statistics 🚇 H
Receive Sensitivity at 6 Mbps (dBm)	-87.0
Receive Sensitivity at 11 Mbps (dBm)	-83.0
Estimated Directional Antenna Gain (dB)	15.0
Packet Reception Model	PHY802.11b Reception Model
] Specify Antenna Model from File	No
[-] Antenna Model	Steerable 👤 🚽
Antenna Pattern Steerable Set Repeat Angle	60 4
[-] Antenna Pattern Type	Traditional
Antenna Azimuth Pattern File	ble/exata/5.1/data/antenna/steerable.antenna-azimuth 4
Antenna Elevation Pattern File	[Optional]
Antenna Gain (dB)	0.0
Antenna Height (meters)	1.5
Antenna Efficiency	0.8
Antenna Mismatch Loss (dB)	0.3
Antenna Cable Loss (dB)	0.0
Antenna Connection Loss (dB)	0.2
Antenna Orientation Azimuth (degrees)	0
Antenna Orientation Elevation (degrees)	0
Temperature (K)	290.0
Noise Factor	10.0
Energy Model	None



3. 实验4B-3: Two-Ray路径损耗

- a. 300m的网格上分布25个节点:
- b. 添加CBR业务:在节点21和5之间
- c. 设定路径损耗模型(PathLoss)模型为Two-Ray: Scenario Properties---》Channel ...

	Chani	nel Properties		
Pro	perty	Value)]	
Number of Channels		1		
	Array Editor			?
	Number of Channels: 1	Prop	erties	
	Index 0 : channel	General		🖾 He
	E.	General	Properties	
		Property	Value	
		Channel Name	channel0	
		Channel Frequency	2.4	GHz 💌
		Pathloss Model	Two Ray	-
		[-] Shadowing Model	Constant	-
		Shadowing Mean (dB)	4.0	
		Fading Model	None	-
		Enable Inter-channel Interfernce	No	-
		Signal Propagation Speed (m/s)	3e8	
		Propagation Limit (dBm)	-111.0	
		Maximum Propagation Distance	0	
		Propagation Communication Proximity	400	
		Propagation Profile Undate Ratio	0.0	

d. 批量实验(Batch Experiment)模式:在Table View中选择节点21的Interface,双击打开属性框;点击 Specify Antenna Model from File 属性栏,然后点击"Add to Batch";然后点击Antenna Height (meters)属性栏,再点击"Add to Batch";这样讲天线高度参数加入到批量实验中,但注意必须首先添加 与待观察参数相依赖的参数。OK后在Table View--》Batch Experiments中会发现已添加的参数

Interface Properties (Interface 16	9.0.0.21)		? ×
Interfaces			🖾 Help
⊡ Interface 0	Iransmission Power at 6 Mbps (dBm)	15.0	
Physical Layer	Transmission Power at 11 Mbps (dBm)	15.0	
Network Layer	Receive Sensitivity at 1 Mbps (dBm)	-94.0	
Routing Protocol BGP Configuration	Receive Sensitivity at 2 Mbps (dBm)	-91.0	
	Receive Sensitivity at 6 Mbps (dBm)	-87.0	
	Receive Sensitivity at 11 Mbps (dBm)	-83.0	_
	Estimated Directional Antenna Gain (dB)	15.0	
	Packet Reception Model	PHY802.11b Reception Model	-
	[-] Specify Antenna Model from File	No	-
	Antenna Model	Omnidirectional	-
	Antenna Gain (dB)	0.0	
	Antenna Height (meters)	1.5	
	Antenna Efficiency	0.8	_
	Antenna Mismatch Loss (dB)	0.3	_
	Antenna Cable Loss (dB)	0.0	_
	Antenna Connection Loss (dB)	0.2	_
	Antenna Orientation Azimuth (degrees)	0	_
	Antenna Orientation Elevation (degre	0	
	Temperature (K)	290.0	_
	Noise Factor	10.0	
	Energy Model	None	
		,	
🔌 Find	Ap	oply OK Cancel Ac	ld To Batch
Mun Experiments			Remove Property
Component	Property	Values	
Interface 169.0.0.21 (host21)	Specify Antenna Model from File Antenna Height (meters)	NO	
		r	

 Table View
 Output Window
 Error Log
 Watch Variables
 Batch Experiments

e. 在相应参数行后的省略号,可以设置参数的对比值:比如,添加天线对比高度3.5

Specify Values	?	×
3.5	Ac	bb
1.5 3.5	Rem	iove
ОК	Car	cel

E Run Experiments				
Component	Property	Values		
Interface 169.0.0.21 (host21)	Specify Antenna Model from File	NO		
Interface 169.0.0.21 (host21)	Antenna Height (meters)	1.5, 3.5		

f. 点击"Run Experiments"

🖀 Run Experiments

g. 有两种方式:交互式和非交互式。系统将自动生成多个应用场景实例: Experiment-1, Experiment-2, 。。。;两种方式运行的差别主要是运行每次实验要不要用户手动点 Play:

Batch Run Mode		?	×
-Run Mode			
C Interactive			
 Non-Interactive 			
	ОК	Can	cel



h. 运行完后,可以在每个Experiment实例的Analyzer中查看统计结果。注意:原始场景4b-3仍然在,可以修改
 Batch Experiments中的参数,继续运行,但是结果将覆盖之前的Experiment-1, Experiment-2, 。。。。
 【可惜不能直接生成对比曲线,不知道Exata是否有此功能】

i. 批量模式运行以下:采用Two-Ray路损模型,天线高度1.5m;对比无衰减、Rayleigh衰减、Ricean衰减 (K=5, Fading Model选择),从收发包数、延迟和端到端吞吐量没有发现差别!【没找到原因】