

Knowledge Representations in Curriculum, Instruction, and Psychometric Modeling

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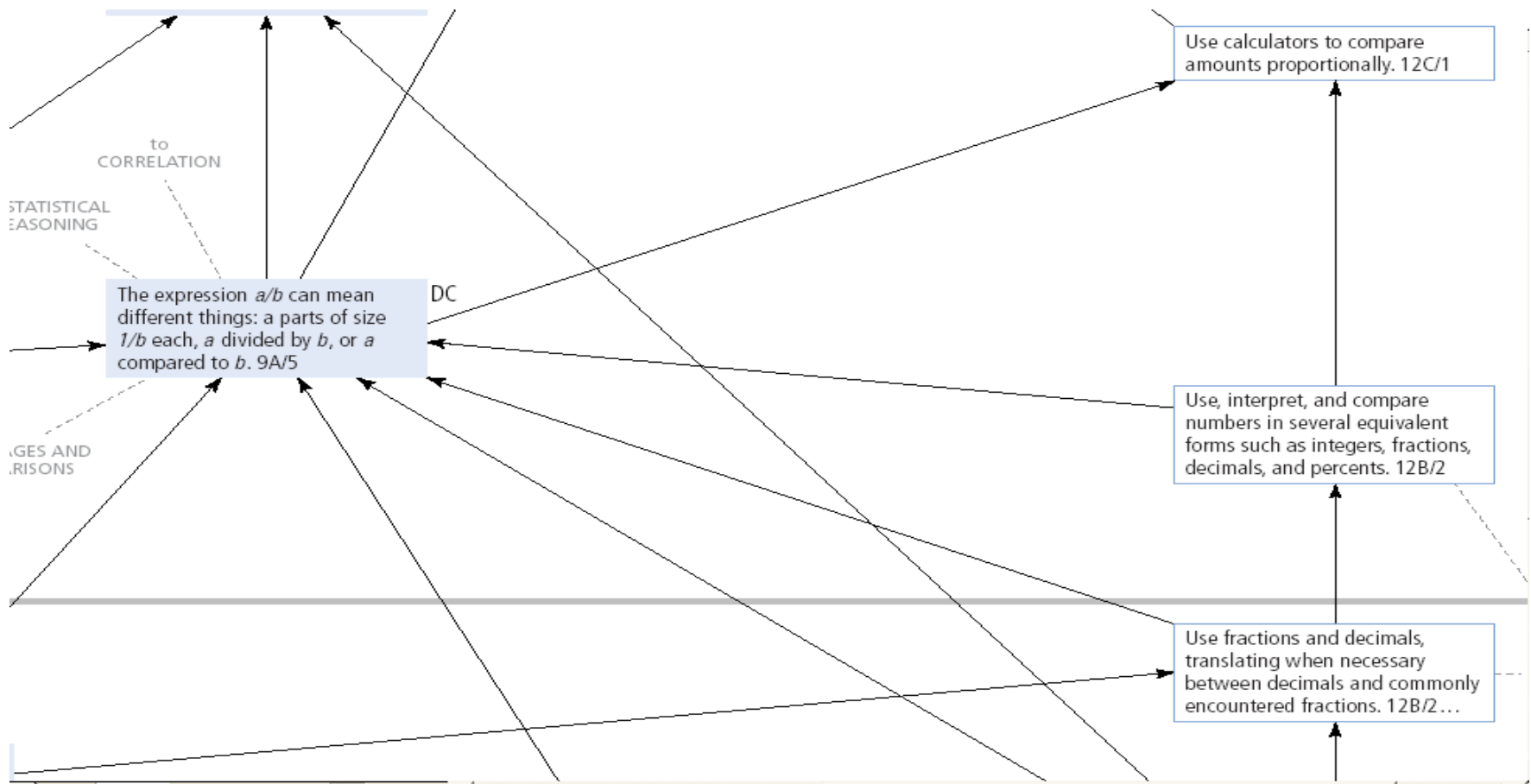
Introduction and Overview

- Distinguish between Domain KRs and Meta-KRs
 - *in v. about* representations
- Meta-KRs
- Domain KRs
- Connections and future work

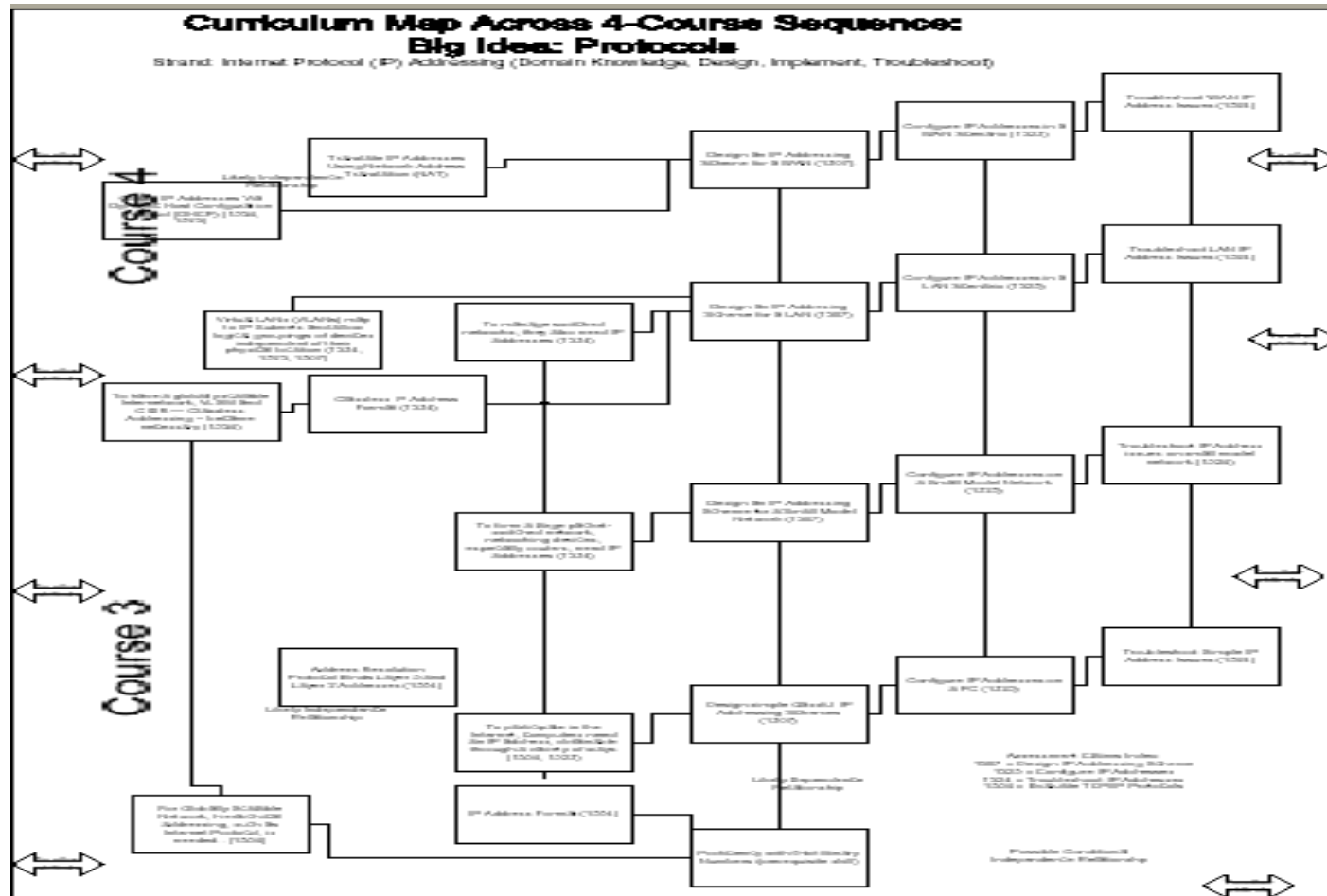
Meta-KRs

- KRs *about* a domain
- Models the hierarchical nature and dependencies of curriculum components
- Closely related to Design KRs
- Informs instruction, task, and assessment design
- AAAS include many examples in their *Atlas of Science Literacy*

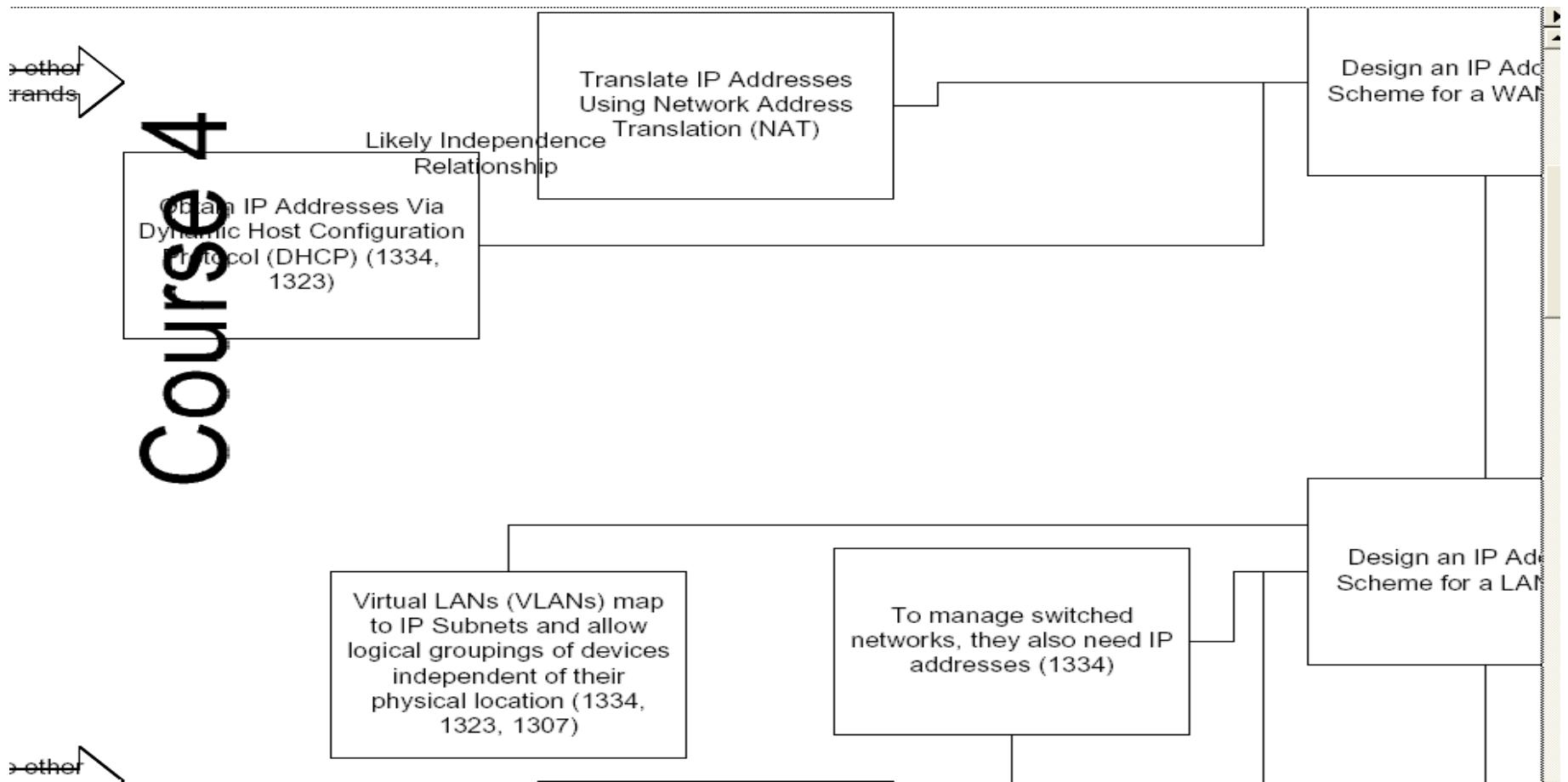
A Closer Look



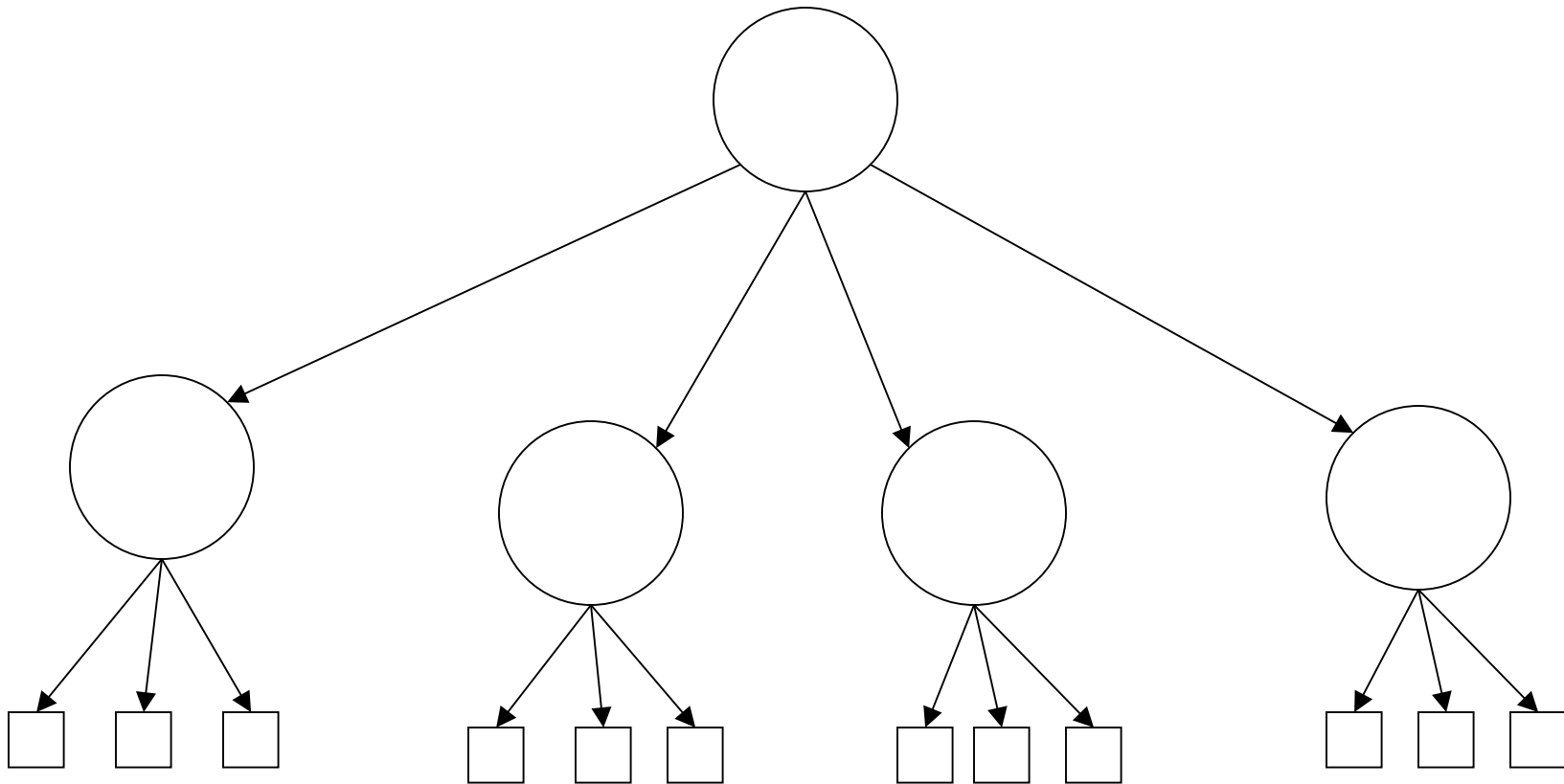
An Example from Cisco: Computer Networking



A Closer Look

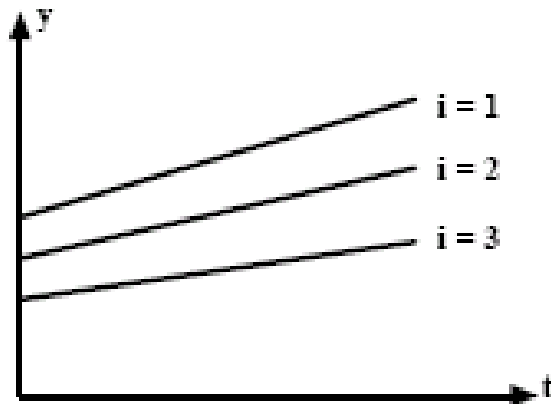


The connection to assessment



- KRs used to interpret, reason, and communicate *within* a domain
- Intricately connected to the domain
- Useful in characterizing expertise
 - Physics problem classification
- KRs highlight and neglect different features

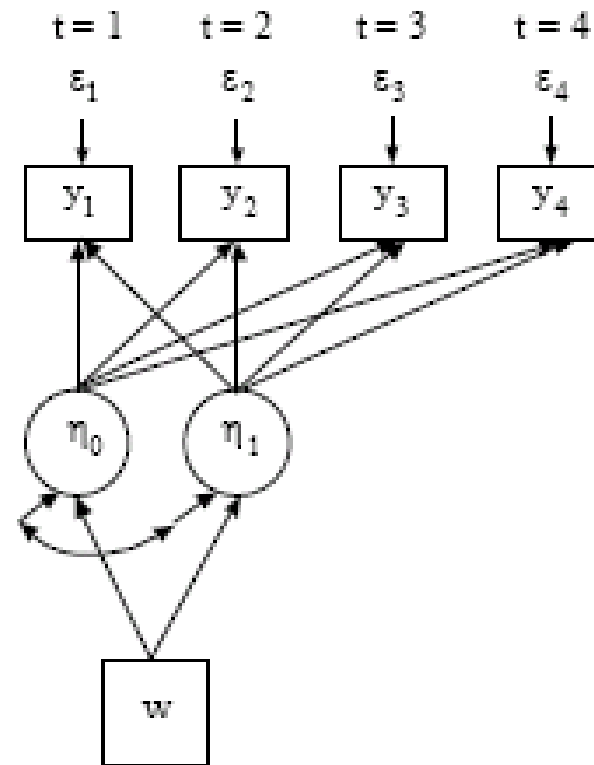
Example: KRs In Growth Modeling



$$y_{it} = \eta_{0i} + \eta_{1i} x_t + \varepsilon_{it}$$

$$\eta_{0i} = \alpha_0 + \gamma_0 w_i + \zeta_{0i}$$

$$\eta_{1i} = \alpha_1 + \gamma_1 w_i + \zeta_{1i}$$



(Used with permission, courtesy of Bengt Muthén)

Example: Packet Tracer

Scenario 0

TIME: 1

PC0 >> PC1

Layer 7: User data
Layer 6
Layer 5
Layer 4: Sequence # = 54232
Layer 3: 11.0.0.2 >> 10.0.0.2
TTL = 32
Protocol = ICMP
Layer 2: 00a017fa 9712
>> 00e01964 3c5e
Layer 1: Port 0

Type	Network	Port	Next Hop IP	Metric
C	1.0.0.0/8	1/0	--	0/0
C	10.0.0.0/8	0/0	--	0/0
R	11.0.0.0/8	1/0	1.1.1.2	120/1

PC0 Router 0 Router 1 PC1

Edit Router 0

```
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is not set

C 1.0.0.0/8 is directly connected, FastEthernet1/0
R 10.0.0.0/8 [120/1] via 1.1.1.1, FastEthernet1/0
C 11.0.0.0/8 is directly connected, FastEthernet0/0
Router #sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
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```

Network Description

This is the simplest routed network. In addition to the logical topology and physical link status indicators, the command line interface representation, OSI model representation, routing table representation, and movie-controlled animated packet representation are present.

Logical Topology

File Options Help

Topology Simulation Realtime

Scenario 0

New Delete

TIME: 1

Layer 7: User data

Layer 6:

Layer 5:

Layer 4: Sequence # = 54232

Layer 3: 11.0.0.2 >> 10.0.0.2
TTL = 32
Protocol = ICMP

Layer 2: 00a0.17fa.9f12 >> 00e0.1964.3c5e

Routing Table for Router 1

Type	Network	Port	Next Hop IP	Metric
C	1.0.0.0/8	1/0	--	0/0
C	10.0.0.0/8	0/0	--	0/0
R	11.0.0.0/8	1/0	1.1.1.2	120/1

Network Description

This is the simplest routed network. In addition to the logical topology and physical...

Edit Router 0

PC0 Router 0 Router 1 PC1

PC0 Router 0 Router 1 PC1

* - candidate default, ∇ - per-user static route, o - ODR

OSI Model View

(RC4) Packet Tracer 3.2 - C:\Program Files\Packet Tracer 3.2\SAVES\CCNA 1\demos\Router-Router.pkt

File Options Help

Topology Simulation Realtime

Scenario 0

New Delete

1 5 10

PC0 >> PC1

Layer 7: <User data>

Layer 6

Layer 5

Layer 4: Sequence # = 54232

Layer 3: 11.0.0.2 >> 10.0.0.2
TTL = 32
Protocol = ICMP

Layer 2: 00e0.177a.9712
>> 00e0.1964.3256

Layer 1: Port 0

Type	Network
	1.0.0.0/8
	10.0.0.0/8
	11.0.0.0/8

PC0 Router 0 Router 1

Edit Router 0

```
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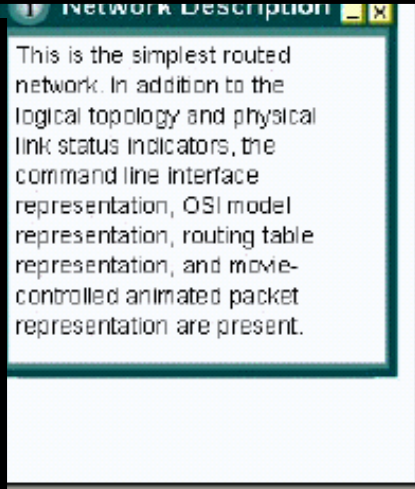
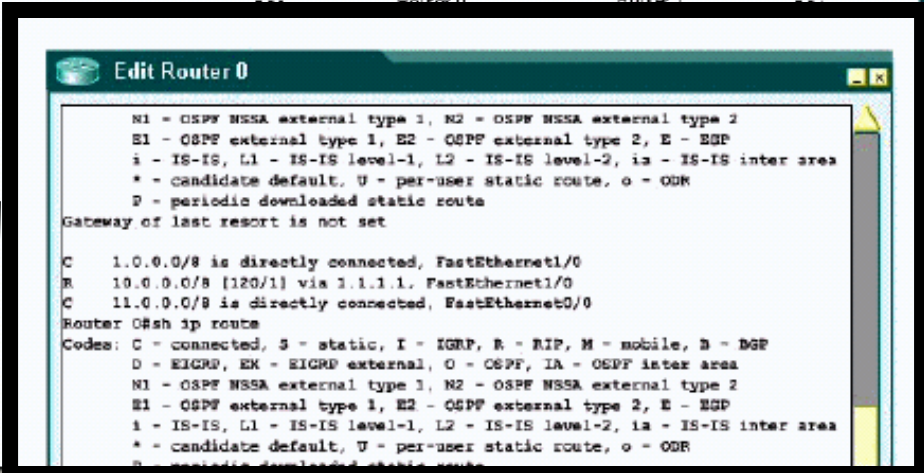
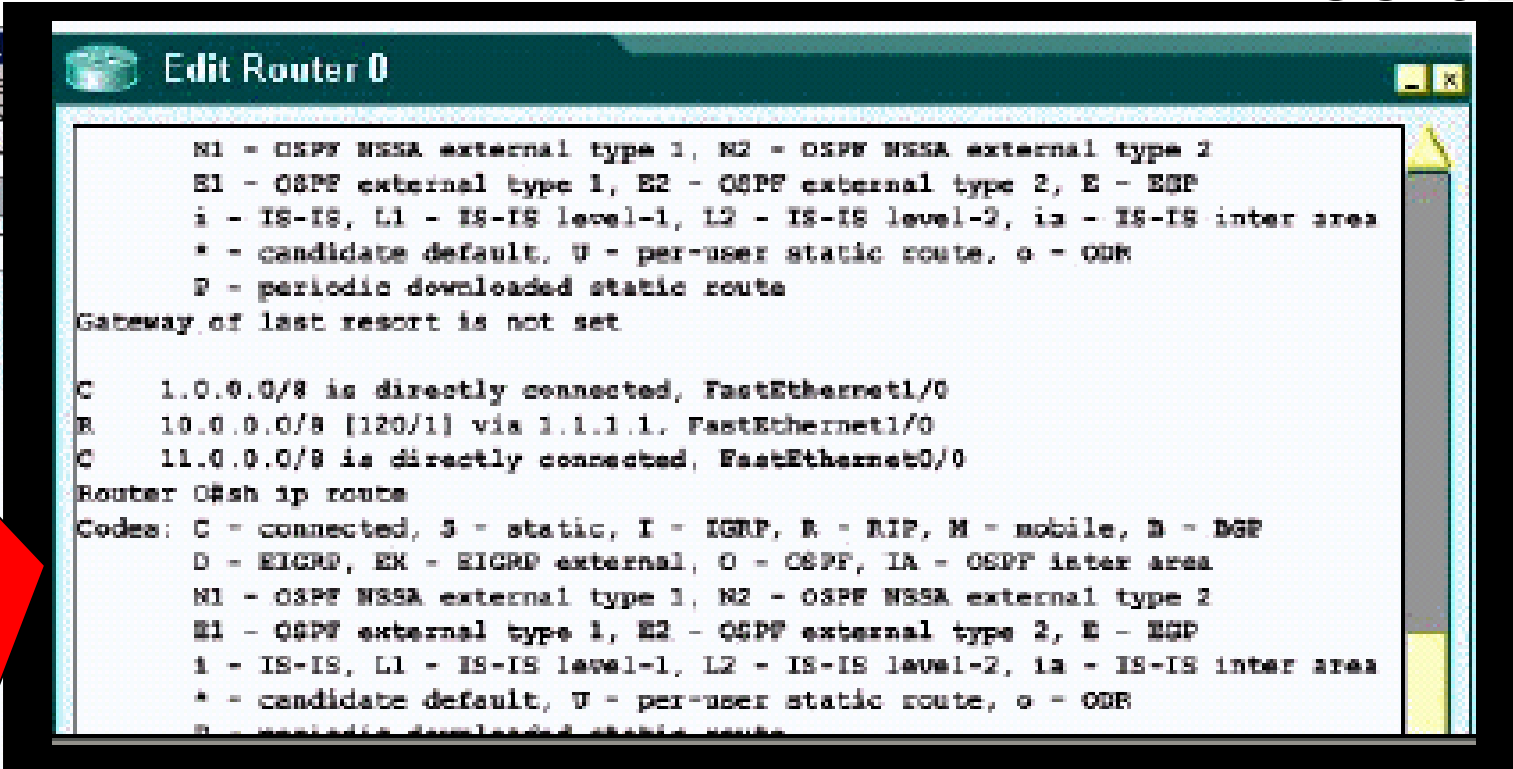

Routing Table

The screenshot shows the Packet Tracer 3.2 interface. The 'Simulation' tab is active, showing a network diagram with PC0, Router 0, Router 1, and PC1. A red arrow points from the 'Routing Table for Router 1' window in the simulation to a larger, detailed view of the same table below.

Type	Network	Port	Next Hop IP	Metric
C	1.0.0.0/8	1/0	--	0/0
C	10.0.0.0/8	0/0	--	0/0
R	11.0.0.0/8	1/0	1.1.1.2	120/1

Routing Table for Router 1				
Type	Network	Port	Next Hop IP	Metric
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R	11.0.0.0/8	1/0	1.1.1.2	120/1

IOS CLI



Edit Router 0

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Router 0#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
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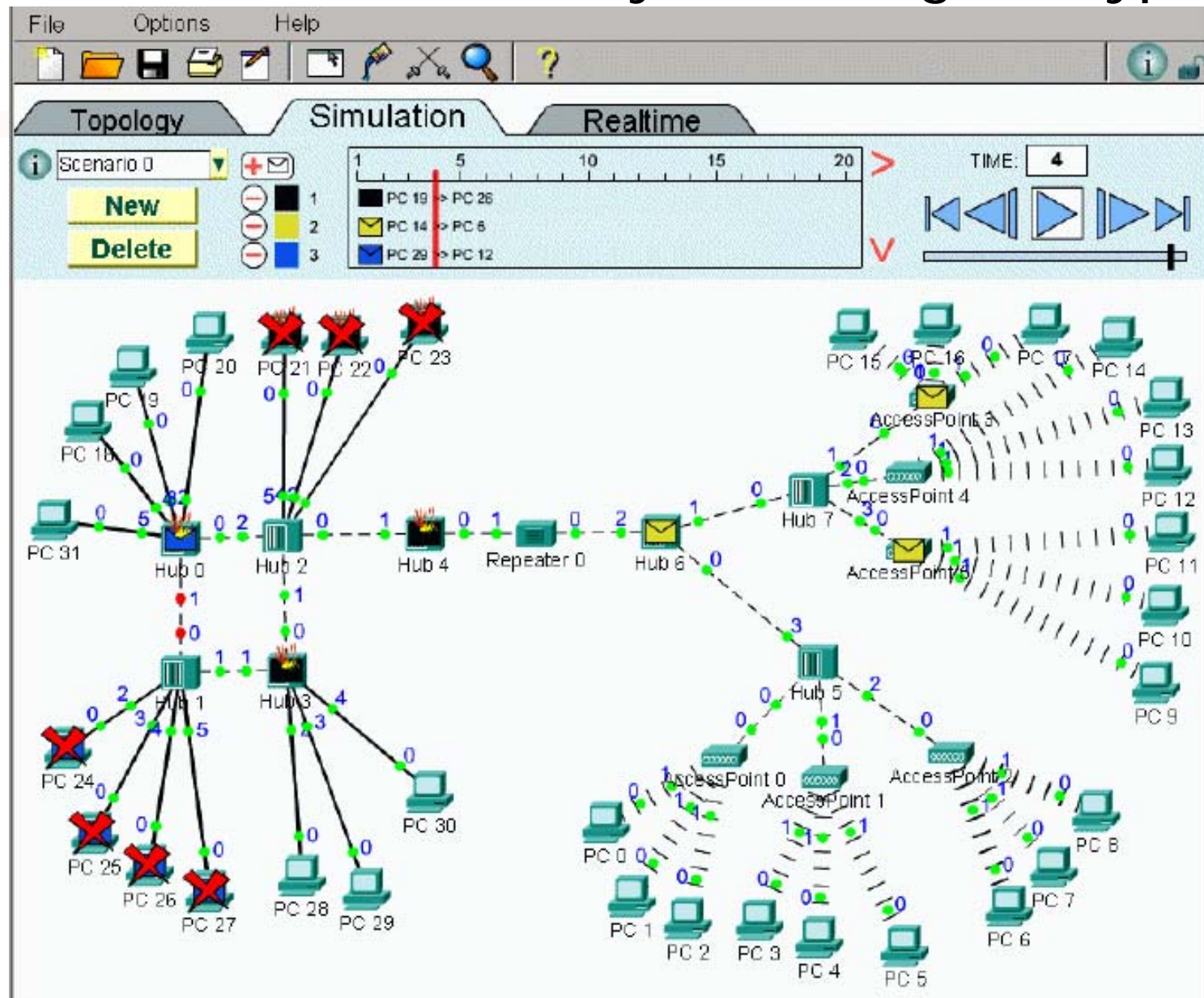
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Dynamic Logical Typology



Domain KRs in Packet Tracer

- Packet Tracer contains the four core KRs for networking professionals
- Simultaneously and dynamically available
- Used to apprentice learners to increasing levels of expertise
- Easily adapted to formative assessment

Packet Tracer Activity: Student Results

This shows the results of the activity. A red check next to a component indicates the completion of that component.

You did not complete the activity. Please close this window and try again.

Activity Results

Network

- Router0**
 - Ports**
 - Part 0/0**
 - Power
 - IP Address
 - Subnet Mask
 - Part 2/0**
 - Power
 - IP Address
 - Subnet Mask
 - Access-group In
 - RIP**
 - Networks**
 - 192.168.4.0
 - 172.16.0.0
 - Access lists**
 - 101
- Router1**
 - Ports**
 - Part 0/0**
 - Power
 - IP Address
 - Subnet Mask
 - Part 2/0**
 - RIP**

Summary

- Required Components** : 26
- Completed Components** : 5

Component Types

P	: 0 / 14
Routing	: 0 / 4
ACL	: 0 / 2
NAT	: 0 / 0
Physical	: 5 / 6
Switching	: 0 / 0
Others	: 0 / 0

Close

Connections and future work

- Meta-KRs are the Domain KR of (Curriculum, Instruction, and Assessment) Design
- Design Patterns as a bridge
 - “I am a part/kind of”
 - “These are parts/kinds of me”
 - Educational standards links to claims
 - Focal and additional knowledge, skills, and abilities
 - Potential observations, work products, rubrics
- Additional applications

Supporting Papers

- All papers can be found on the following website
 - <http://www.education.umd.edu/EDMS/mislevy/index.html>