

Why currency?

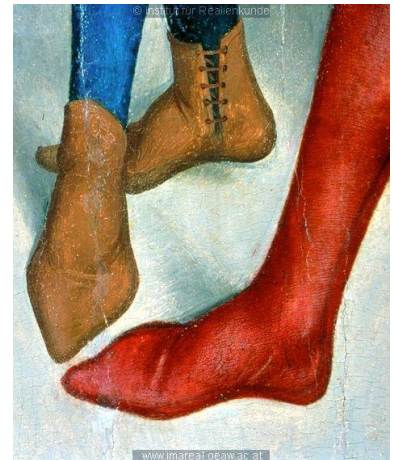
# How has this problem been solved in history?

- “Currency” has emerged in **every** community / civilization in history (including in prison and prison camps) because it solves a basic need in all human exchange
- Currency is always a localized phenomenon and has evolved with changes in economic needs based on the “best” available economic good (information protocol)

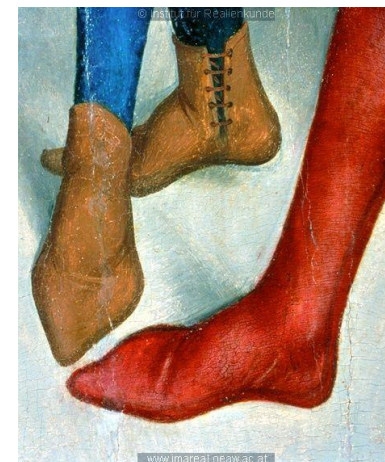
Specialization increases productivity (dramatically)



# But requires exchange

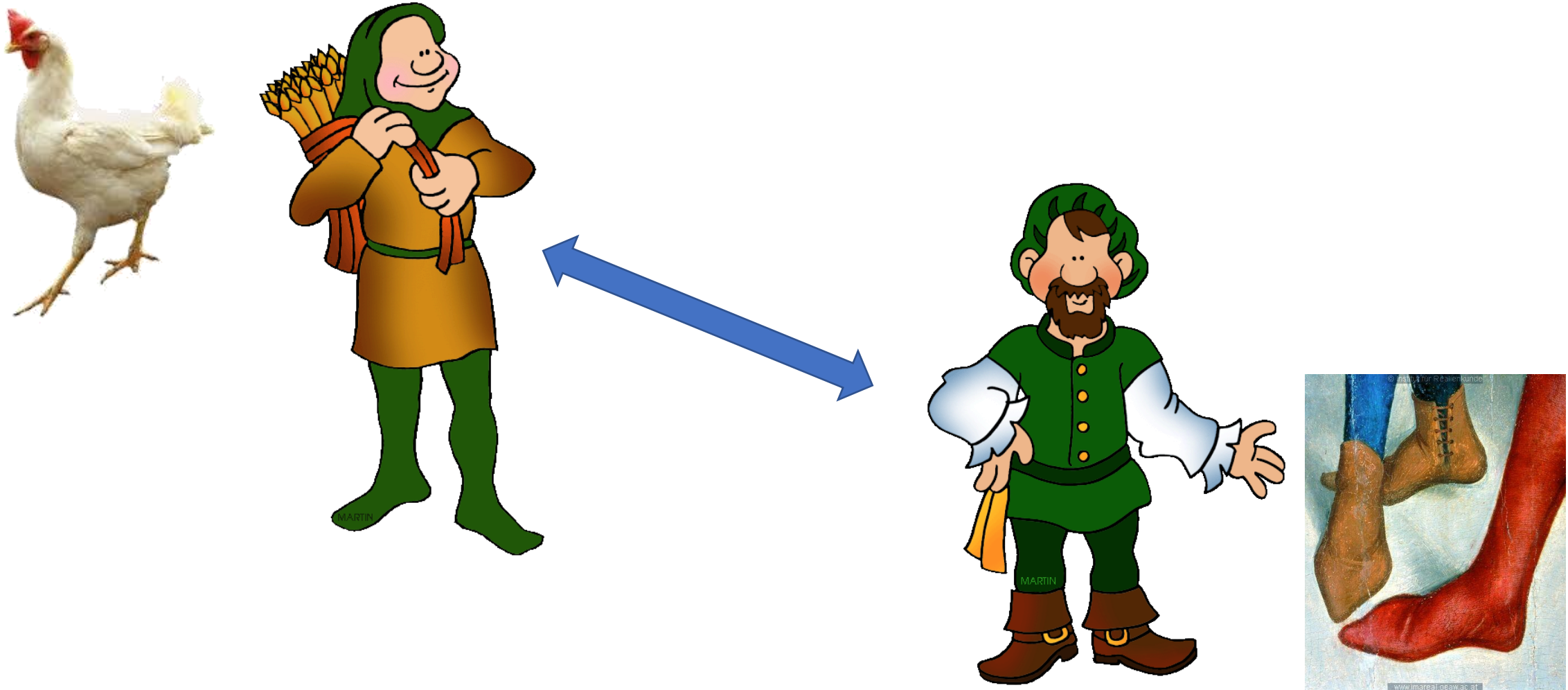


# And resolves the double coincidence of wants

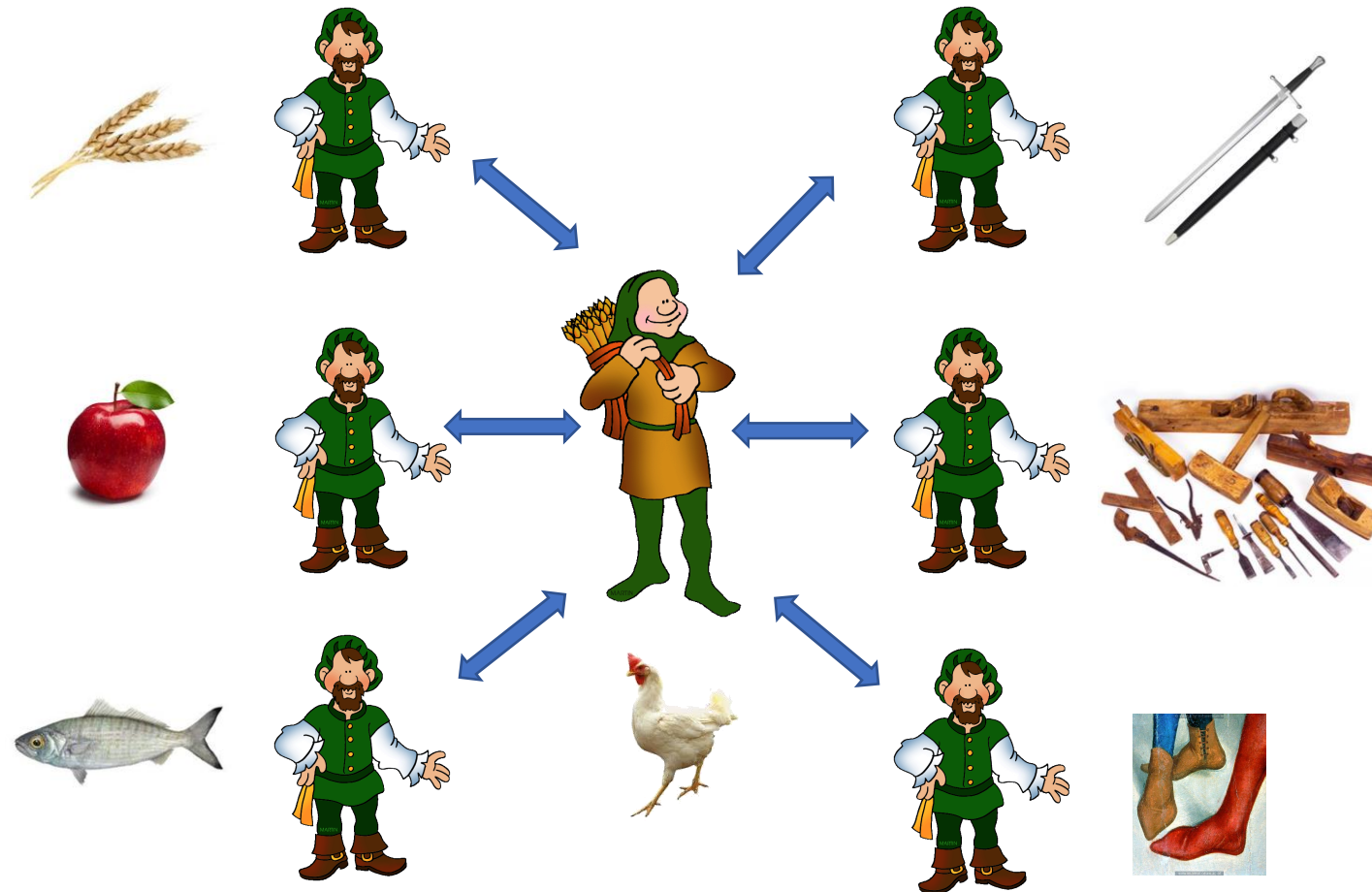


Currency solves the exchange  
problem

# Exchange in small groups is easy

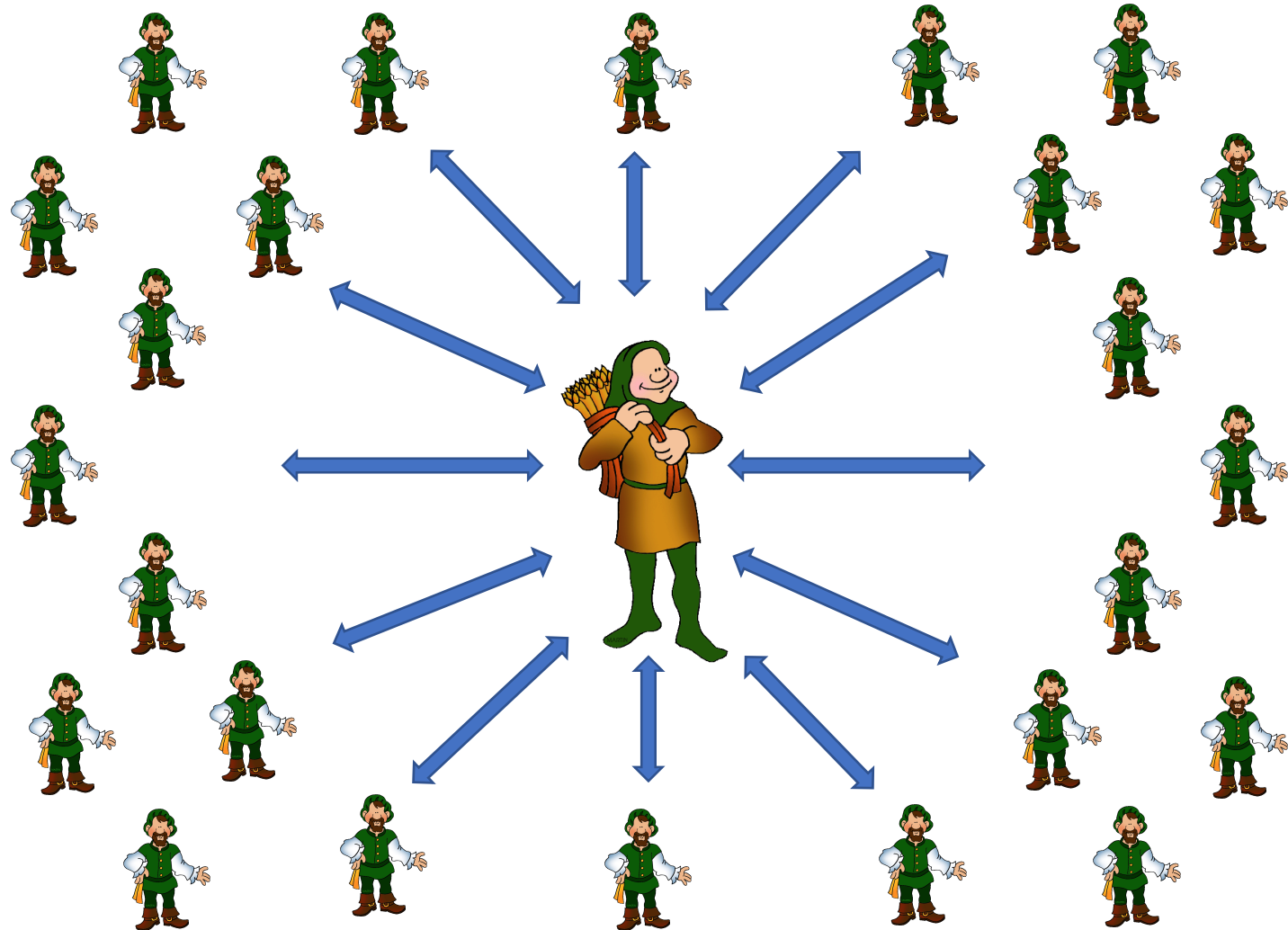


# Gets harder as groups get larger





And more complicated as the group gets even larger



# Evolution of the exchange problem

- Small group (< 50) – reciprocity (based on exchange with trust)
- Medium-sized groups (> 150) – commodity currency (initially based on objective utility)
- Large groups (thousands to millions) – commodity currency (based on precious metals)
- Really large groups (nation states) – government-issued currency (based on collective trust)

Barter is one of the great economic myths:  
represents single coincidence of wants  
(which is very rare)

Currency is the grease that makes the economy work



Currency emerges as the intermediate good  
used in exchange/trade as an  
information / value place holder

# Currency can be anything



cigarettes  
(war/prison camps)



Poker chips  
(casino)



The “mack”  
(prison)

# It has been ...



Cowrie shells  
(Sub-Saharan Africa)



Salt (Northern Africa)



Barley (Mesopotamia)



Beaver pelts  
(North America)



Then standardized to...



Gold



Silver

# Because of their superior physical properties

1. Can't be a gas
2. Can't be radioactive
3. Can't be too common
4. Can't be too rare
5. Easy to work with\*

PERIODIC TABLE OF THE ELEMENTS

GROUP																		18							
1		2												13		14		15		16		17		18	
1A		2A												IIIA		IVA		VA		VIA		VIIA		VIIIA	
1	1.008																								
1	H																								
	HYDROGEN																								
2	Li	Be																							
	LITHIUM	BERYLLIUM																							
3	Na	Mg																							
	SODIUM	MAGNESIUM																							
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr							
	POTASSIUM	CALCIUM	SCANDIUM	TITANIUM	VANADIUM	CHROMIUM	MANGANESE	IRON	COBALT	NICKEL	COPPER	ZINC	GALLIUM	GERMANIUM	ARSENIC	SELENIUM	BROMINE	KRYPTON							
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe							
	RUBIDIUM	STRONTIUM	YTTRIUM	ZIRCONIUM	NIOBIUM	MOLYBDENUM	TECHNETIUM	RUTHENIUM	RHODIUM	PALLADIUM	SILVER	CADMIUM	INDIUM	TIN	ANTIMONY	TELLURIUM	IODINE	XENON							
6	Cs	Ba	La-Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn							
	CAESIUM	BARIUM	Lanthanide	HAFNIUM	TANTALUM	TUNGSTEN	RHENIUM	OSMIUM	IRIDIUM	PLATINUM	GOLD	MERCURY	THALLIUM	LEAD	BISMUTH	POLONIUM	ASTATINE	RADON							
7	Fr	Ra	Ac-Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og							
	FRANCIUM	RADIUM	Actinide	RUTHERFORDIUM	DUBNIUM	SEABORGIUM	BOHRIUM	HASSIUM	MEITNERIUM	DARMSTADIUM	ROENTGENIUM	COPERNICIUM	NIHONIUM	FLEROVIUM	MOSCOVIUM	LIVERMORIUM	TENNESSINE	OGANESSON							

GROUP NUMBERS  
IUPAC RECOMMENDATION  
(1985)

GROUP NUMBERS  
CHEMICAL ABSTRACT SERVICE  
(1986)

ATOMIC NUMBER

SYMBOL

RELATIVE ATOMIC MASS (1)

ELEMENT NAME

B

10.811

BORON



(1) Atomic weights of the elements 2013, Pure Appl. Chem., 88, 265-291 (2016)

## LANTHANIDE

57 La LANTHANUM	58 Ce CERIUM	59 Pr PRASEODYMIUM	60 Nd NEODYMIUM	61 (145) Pm PROMETHIUM	62 Sm SAMARIUM	63 Eu EUROPIUM	64 Gd GADOLINIUM	65 Tb TERBIUM	66 Dy DYSPROSIUM	67 Ho HOLMIUM	68 Er ERBIUM	69 Tm THULIUM	70 Yb YTTERIUM	71 Lu LUTETIUM
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## ACTINIDE

89 Ac ACTINIUM	90 Th THORIUM	91 Pa PROTACTINIUM	92 U URANIUM	93 (237) Np NEPTUNIUM	94 (244) Pu PLUTONIUM	95 (243) Am AMERICIUM	96 (247) Cm CURIUM	97 (247) Bk BERKELIUM	98 (251) Cf CALIFORNIUM	99 (252) Es EINSTEINIUM	100 (257) Fm FERMIUM	101 (258) Md MENDELEVIUM	102 (259) No NOBELIUM	103 (262) Lr LAWRENCIUM
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\*Platinum and Palladium have melting temperatures requiring 1860's blast furnace technology



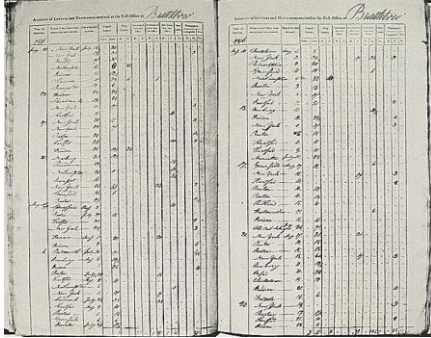
And eventually ...



Bank notes



# Economists believe currency plays 3 primary roles in an economy



1. Unit of account



2. Medium of exchange



????

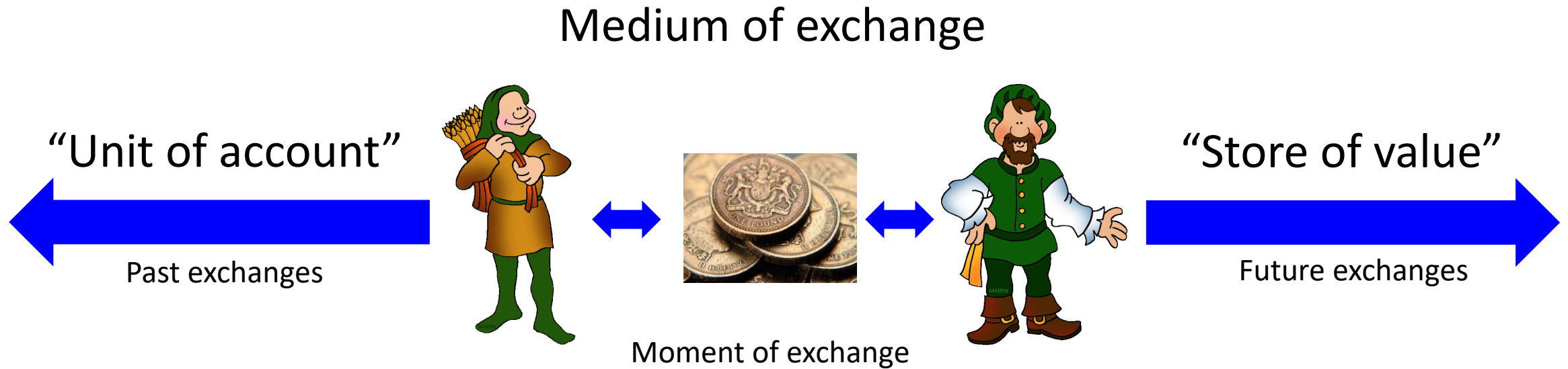
3. Store of value

# Economists are wrong ...

- All uses of currency are a function of time:
  - Medium of exchange – time equals the present
  - Store of value is medium of exchange at a point in the future
  - Unit of account is medium of exchange for all time periods up to the point of exchange

Currency is only a *medium of exchange*

# In reality, currency plays only one role

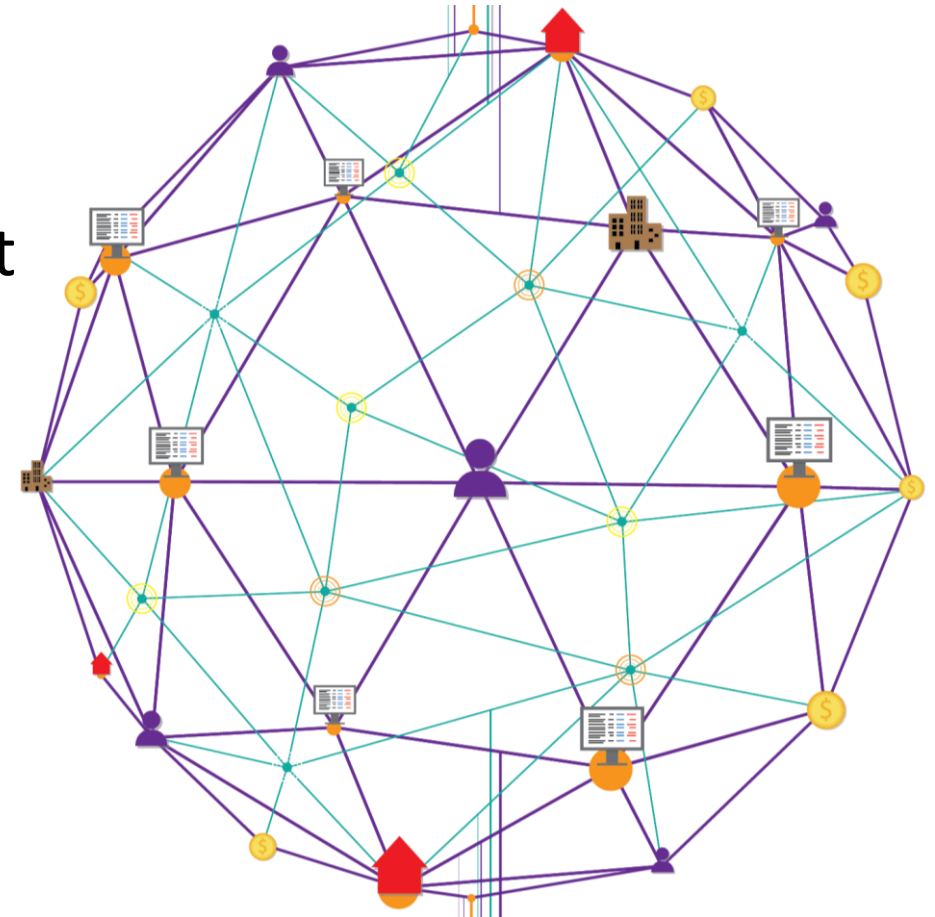


# Currency is an information protocol \*

\* The form of the currency is essentially irrelevant – it is the information that the protocol expresses that is important

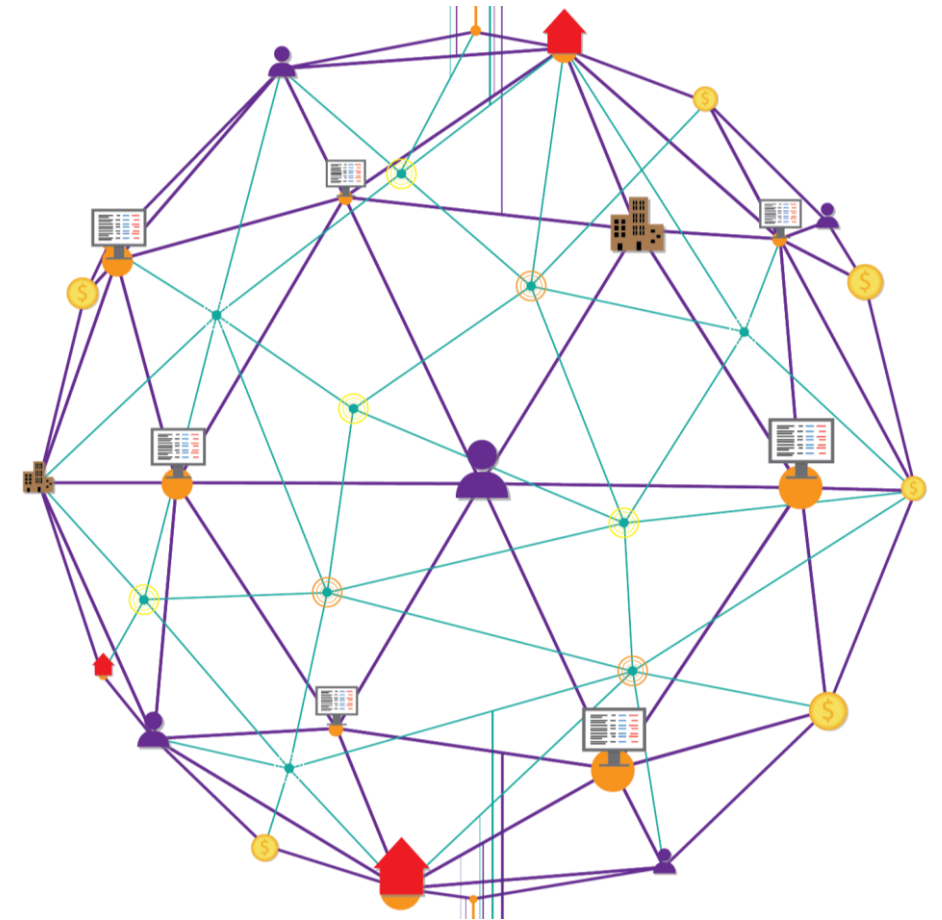
# Best modeled as an information exchange network

- Dots (nodes) = economic agents
- Lines (edges) = economic activity -> exchange/trade
- Not all links are active at all times (represent ***potential*** exchange state)
- Protocols emerge in all networks for efficiency allowing each agent to optimize flow



# Economies are exchange networks

- Currency is the *exchange protocol* between nodes (N) in an economic network
- The protocol is a function of the number of nodes that accept it
- Value of the protocol is  $= f(N-1)^2$
- Most networks exhibit winner take most (all) tendencies



Currency is a collective belief system serving  
as an exchange protocol



# Because currency is an exchange protocol

- The “value” of currency:
  - materializes and becomes tangible **only** when it is exchanged for a good or service
  - is realized when one person puts trust in the currency at the moment of the exchange
  - is impossible to determine except at the point of exchange
- It is at the point of exchange (which is an “an act of faith”) that the value of an intrinsically worthless item (i.e. piece of paper) becomes a reality