

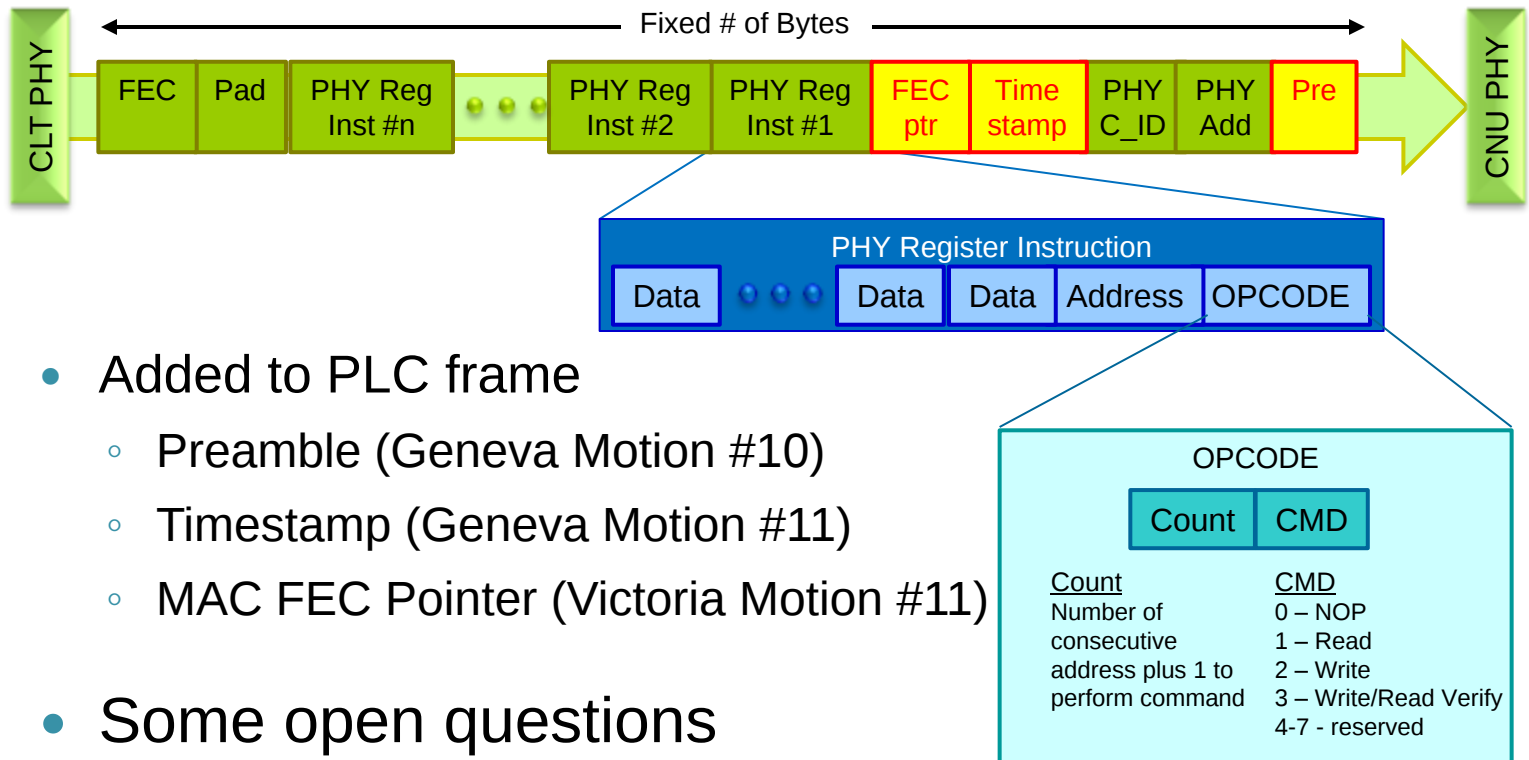


Minimum PLC Frame

Outline

- DS PLC frame contents proposed to date
- Assumptions
- Implications of PLC frame content on minimum frame size

PHY Link Frame



- Added to PLC frame
 - Preamble (Geneva Motion #10)
 - Timestamp (Geneva Motion #11)
 - MAC FEC Pointer (Victoria Motion #11)
- Some open questions
 - What does the US PLC frame look like?
 - Must be aligned with US OFDM frame
 - What controls access to US PLC?
 - Will CSMA/CD work?

PLC Frame assumptions

- Some field sizes/values assumed for purposes of illustration

Item	Value	Units
OFDM clock frequency	204.8	Mhz
OFDM clock period	4.883	ns
PLC Modulation	16	QAM
PLC bit loading	4	b/Hz
PLC Spectrum	400	kHz/PLC
PLC Raw Data Cap (PLC_DC)	1600	kb/PLC
DS PLC Preamble	8	sym

Field	size (b)
Fixed OH	98
DA	48
PHY_Config	2
Timestamp	32
FEC_ptr	16
PHY WR Inst (min)	40
Opcode	3
Count	5
Addr	16
data	16
PHY WR Inst (max)	520
Opcode	3
Count	5
Addr	16
data	496
Misc	
Pad	
FEC	m * 96

Calculations

Components

- PLC Frame – length of PLC frame in symbols
- CP – minimum CP
- Total Frame – duration of frame in us
 - $= (\text{Sym} + \text{CP}) \times \text{PLC_Frame}$
- PLC Preamble – duration of preamble
 - $= (\text{Sym} + \text{CP}) \times 8$
- PLC Data Frame – aggregate duration of data carrying symbols (excluding preamble)
 - $= (\text{PLC_Frame} - 8) \times \text{Sym}(\text{us})$
- Data Capacity – data carrying capacity of the PLC Frame
 - $= \text{PLC_DC} / \text{PLC_Data_Frame}$
- Post FEC – data capacity after FEC
 - $= \text{Data_Cap} - (96 \times \text{ceiling}(\text{Data_Cap} / 96))$
- Post Fixed - data capacity after fixed Overhead removed
 - $(\text{PHY_Add}, \text{PHY_Config}, \text{Timestamp}, \text{FEC_Ptr})$
 - $= \text{Post_Fec} - 98$
- PHY_Inst Capacity (min) – number of 1 word write instructions
- PHY_Inst Capacity (max) – number of 31 word write instructions
 - $= \text{floor}(\text{Post_Fixed} / \text{PHY_Inst_Len})$
- Pad
- PLC Data Rate – effective data rate
 - $= \text{PHY_Inst_Cap} \times (31) / \text{Total_Frame}$

Implications

- 8k FFT

Component	FAILS	Min PLC Frame		Unit
PLC Frame	38	39	39	Sym
CP	0.9375	0.9375	5.00	us
Total Frame	795.6	816.6	975.0	us
PLC Preamble	167.5	167.5	200.0	us
PLC Data Frame	600	620	620	us
Data Capacity	960	992	992	bit
Post FEC	576	608	608	bit
Post Fixed	517	549	549	bit
PHY_Inst Capacity (min)	11	11	11	Inst.
Pad	-	32	32	bit
PHY_Inst Capacity (max)	-	1	1	Inst.
Pad	517	6	6	bit
PLC Data Rate	650	672	563	kbps

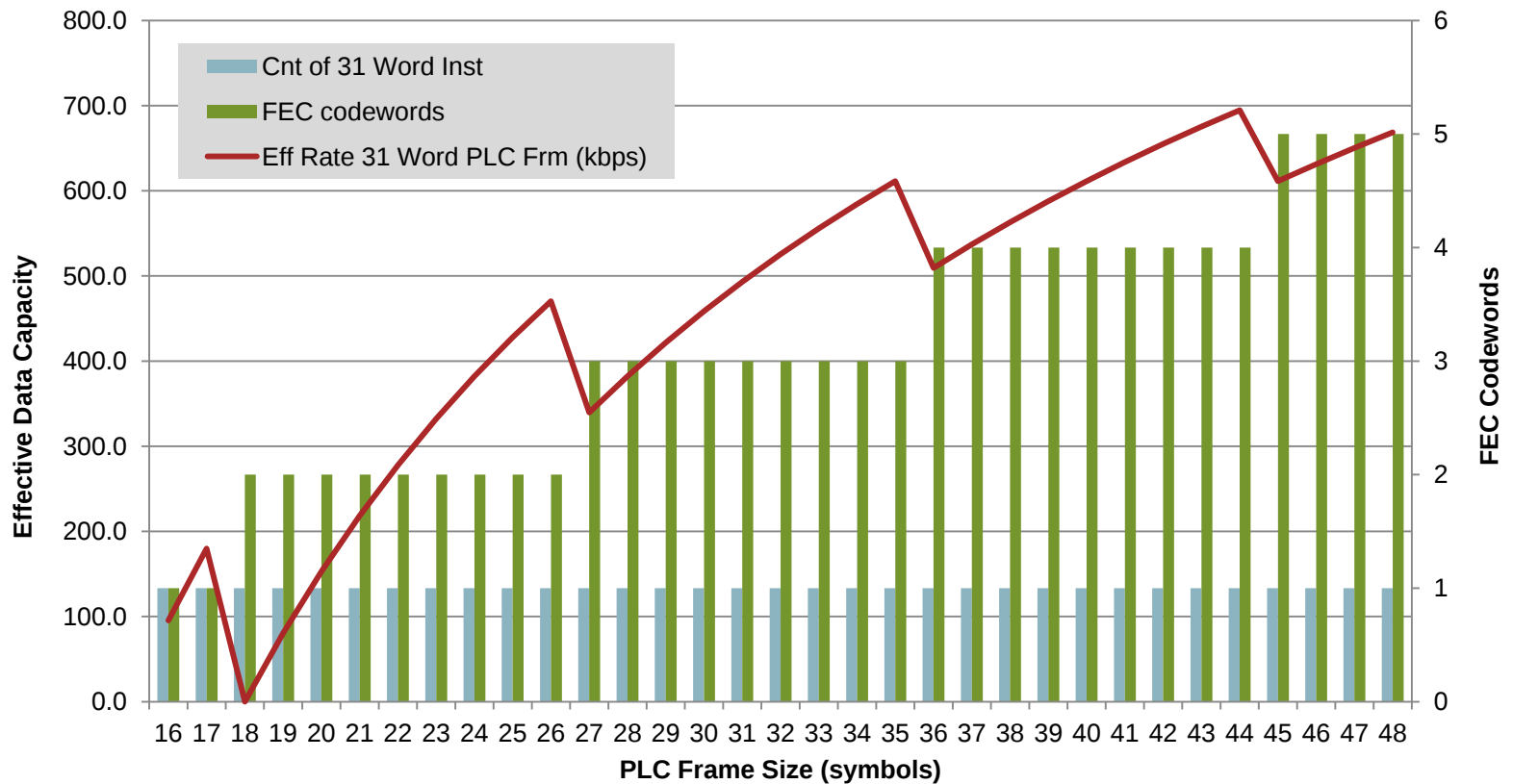
Implications

- 4k FFT

Component	FAILS	Min PLC Frame		Unit
PLC Frame	23	24	24	Sym
CP	0.9375	0.9375	5.00	us
Total Frame	941.6	982.5	1,080.0	us
PLC Preamble	327.5	327.5	360.0	us
PLC Data Frame	600	640	640	us
Data Capacity	960	1,024	1,024	bit
Post FEC	576	640	640	bit
Post Fixed	517	581	581	bit
PHY_Inst Capacity (min)	11	12	12	Inst.
Pad	-	17	17	bit
PHY_Inst Capacity (max)	-	1	1	Inst.
Pad	517	38	38	bit
PLC Data Rate	549	591	538	kbps

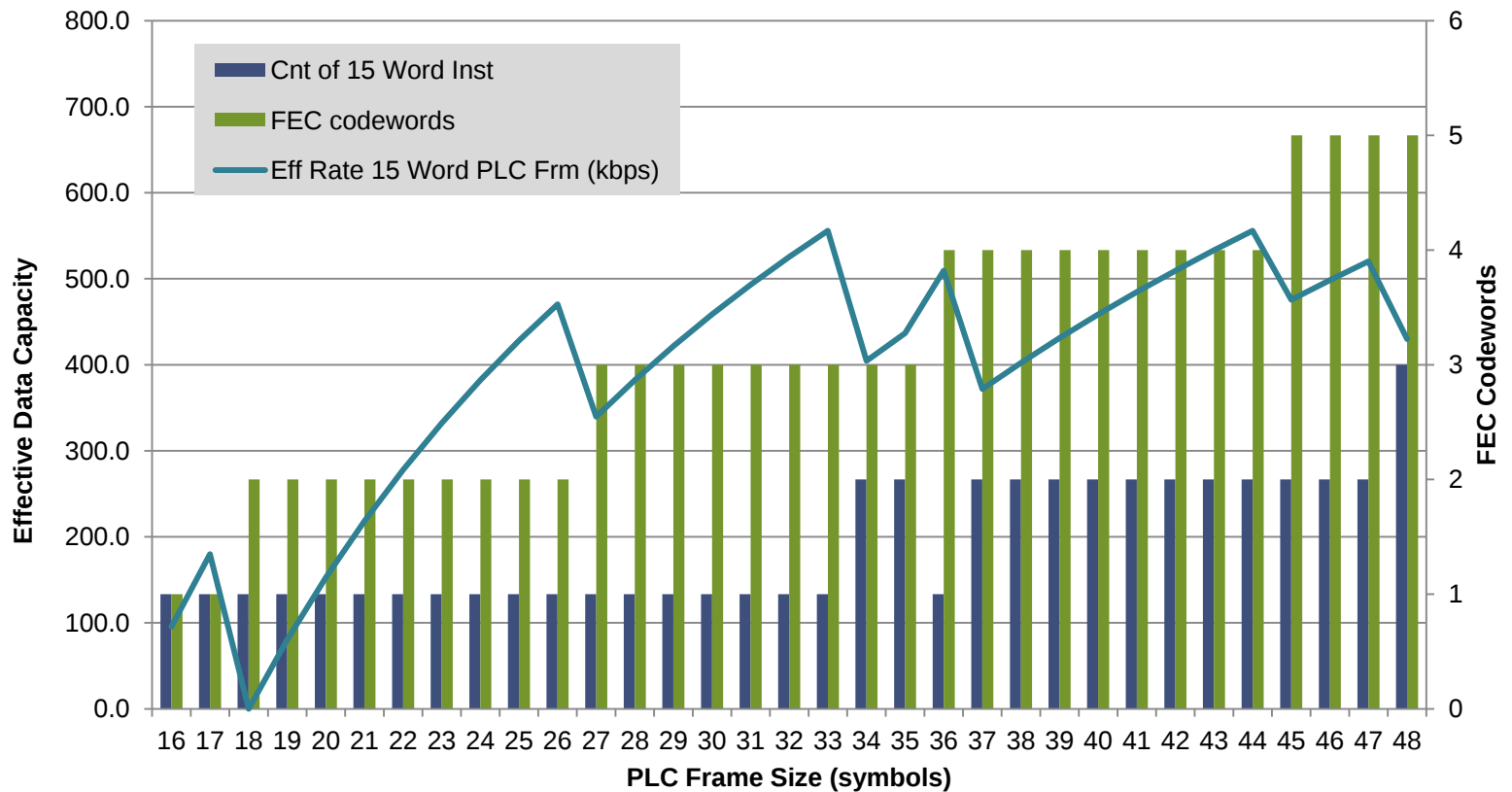
Frame size

- PHY Instructions with 31 Reg Writes



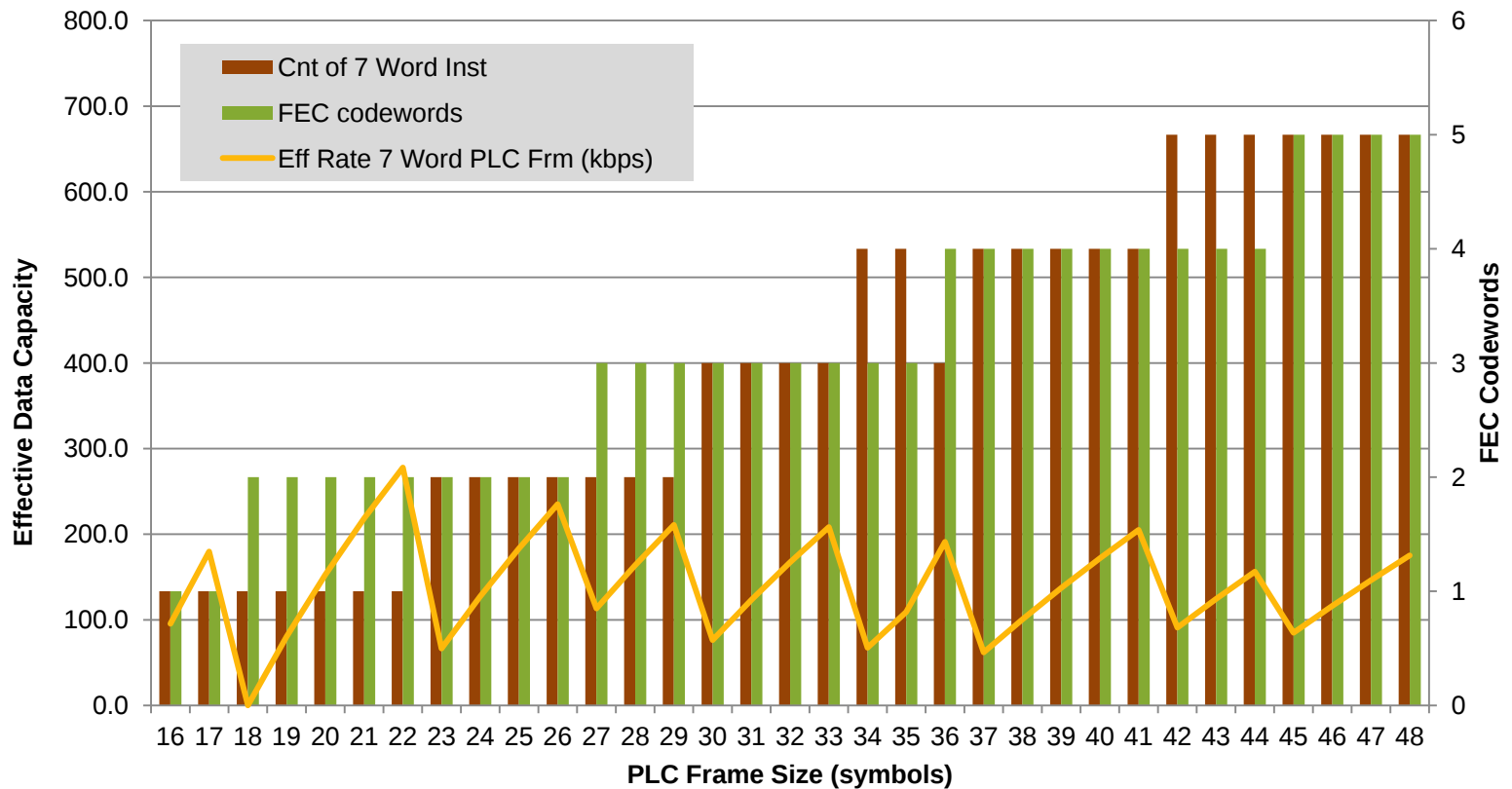
Frame size

- PHY Instructions with 15 Reg Writes



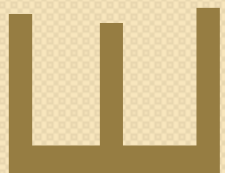
Frame size

- PHY Instructions with 7 Reg Writes



Conclusion

- Lots of things will impact PLC data capacity
- PLC Frame should always allow for a maximum size PLC Instruction
- Need to define US PLC with minimum overhead



Questions?



THANK YOU